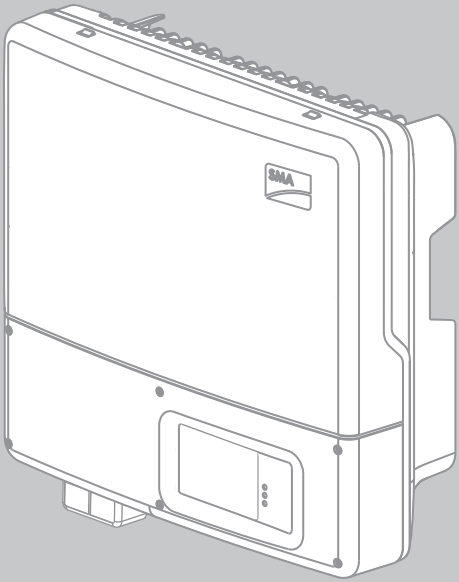
PV Inverter

SUNNY BOY 3600TL

Installation Guide



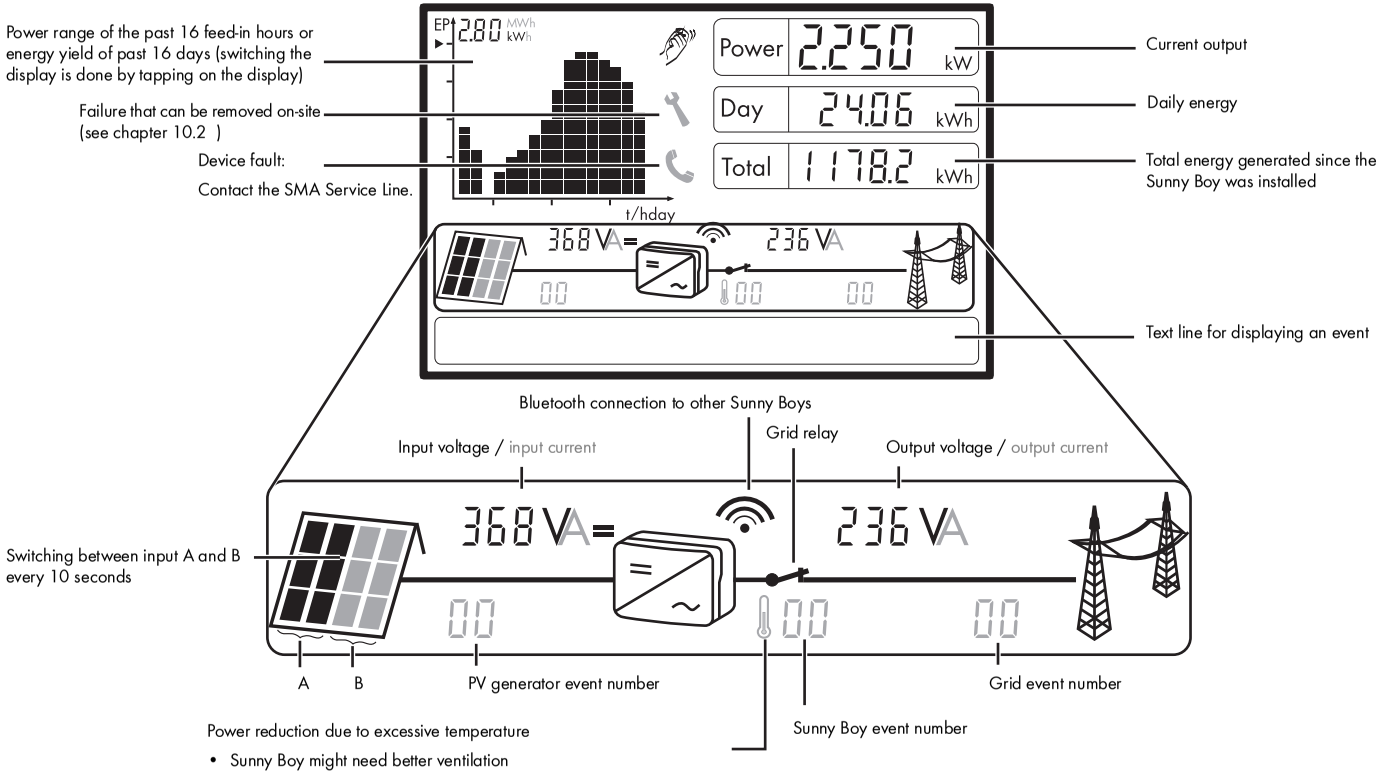
SB36TL-20-IA-IEN115010 | IMEN-SB36TL | Version 1.0

EN

Display

Tapping on the lower lid:

- Activating the background illumination
- Switching through the energy values of the past 16 feed-in hours to the daily energy values of the past 16 days
- Switching through the line display


Power range of the past 16 feed-in hours or energy yield of past 16 days (switching the display is done by tapping on the display)
Failure that can be removed on-site (see chapter 10.2)
Device fault:
Contact the SMA Service Line.
EP
2.80 MWh kWh
t/hday
Power 2.250 kW
Day 24.06 kWh
Total 1178.2 kWh
Current output
Daily energy
Total energy generated since the Sunny Boy was installed
368 VA
236 VA
Text line for displaying an event
Bluetooth connection to other Sunny Boys
Grid relay
Input voltage / input current
Output voltage / output current
Switching between input A and B every 10 seconds
A
B
PV generator event number
Grid event number
Sunny Boy event number
Power reduction due to excessive temperature
• Sunny Boy might need better ventilation

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1 Notes on this manual

1.1 Validity

This manual describes the assembly, installation, commissioning and maintenance of the following SMA inverters:

- Sunny Boy 3600TL (SB 3600TL-20)

Keep this guide in a convenient place for future reference.

1.2 Target group

This manual is for qualified electricians. The tasks described in this manual may be performed by electrically qualified persons only.

1.3 Additional Information

You will find further information on special topics such as designing a line circuit breaker or the description of the parameters and measurement readings in the download area at www.SMA.de/en.

Refer to the User Manual provided for detailed information on operating the inverter.

1.4 Symbols Used

The following types of safety precautions and general information are used in this manual:

DANGER!

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!

WARNING indicates a safety instruction, the failure to observe which will result in immediate death or serious injury.

CAUTION!

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE!

NOTICE indicates a situation that can result in property damage if not avoided.

Information

Information provides tips that are valuable for the optimal installation and operation of your product.

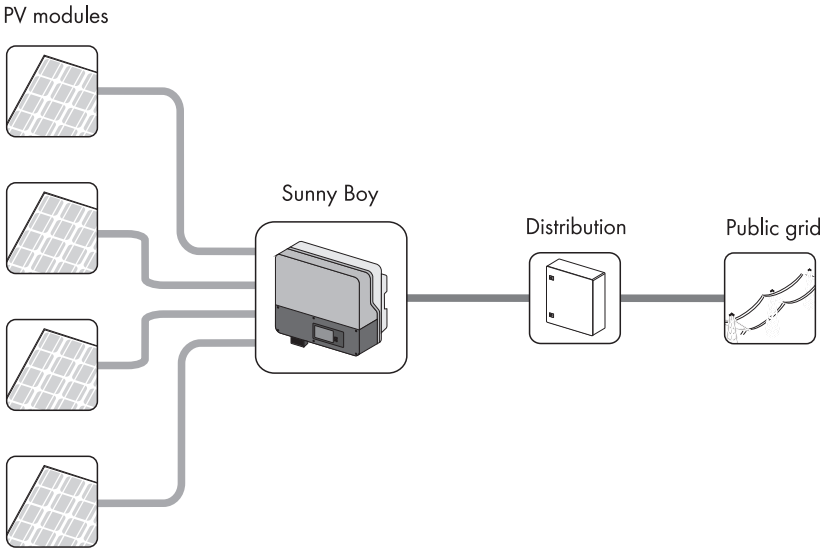
☑ This symbol indicates the result of an action.

2 Safety

2.1 Appropriate usage

The Sunny Boy is a PV inverter which converts the DC current of a PV generator into AC current and feeds it into the public grid.

Principle of a PV System with this Sunny Boy



The inverter may only be operated with PV generators (PV modules and cabling) of protection class II. Do not connect any sources of energy other than PV modules to the inverter.

Capacitive Discharge Currents

PV modules with large capacities relative to ground, such as thin-film modules with cells on a metallic substrate, are only to be implemented if their coupling capacity does not exceed 1,400 nF.

During grid feeding, a discharge current flows from the cells to ground. The amount of current depends on the manner in which the modules are installed (e.g. foil on metal roof) and on the weather (rain, snow). This "normal" discharge current may not exceed 50 mA due to the fact that the inverter would otherwise automatically disconnect from the grid as a protective measure. For further information on this subject, see the Technical Information "Capacitive Discharge Currents" in the download area at www.SMA.de/en.

When designing the PV system, ensure that the values comply with the permitted operating range of all components at all times. The free design program "Sunny Design" (www.SMA.de/en/SunnyDesign) will assist you. The manufacturer of the PV modules must have approved the modules for use with this inverter.

You must also ensure that all measures recommended by the module manufacturer for long-term maintenance of the module properties are taken (see also Technical Information "Module Technology", in the download area of www.SMA.de/en).

Do not use the inverter for purposes other than those described here. Changing the product or installing components that are not explicitly recommended or sold by SMA Solar Technology AG is prohibited for safety reasons..

Certified Countries

The Sunny Boy 3600TL (with according configuration) fulfill the requirements specified in the following standards and directives (dated: 2011/12):

- G83/1-1
- EN 50438

SMA Solar Technology AG can preset special grid parameters for other countries/installation locations according to customer requests, after evaluation by SMA Solar Technology AG.

You can make later modifications yourself by changing software parameters with respective communication products (e.g. Sunny WebBox or Sunny Explorer). To change grid-relevant parameters, you need a personal access code - the so-called SMA Grid Guard Code. The application form for the personal access code is located in the download area at www.SMA.de/en, in the "Certificate" category for each inverter.

2.2 Safety instructions

DANGER!

Danger to life due to high voltages in the inverter.

- All work on the inverter may only be carried out by qualified personnel.
- The appliance is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.
- Children should be supervised to ensure that they do not play with the appliance.

CAUTION!

Parts of the enclosure can become hot - risk of burn injuries!

During operation, the upper lid of the enclosure and the enclosure body may become hot.

- Only touch the lower enclosure lid during operation.

CAUTION!

Possible damage to health as a result of the effects of radiation!

- Do not stay closer than 20 cm to the inverter for any length of time.

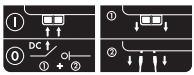
Grounding the PV generator

Comply with the local regulations for grounding the modules and the PV generator. SMA Solar Technology AG recommends connecting the generator frame and other electrically conductive surfaces in a manner which ensures continuous conduction, and grounding these to ensure maximum protection for systems and personnel.

2.3 Explanation of Symbols

This section gives an explanation of all the symbols found on the inverter and on the type label.

2.3.1 Symbols on the Inverter

Icon	Explanation
	Operation Display. Indicates the operation condition of the inverter.
	An error has occurred. Read section 11 "Troubleshooting" (page 68) to remedy the error.
	Tap to switch on the display light and switch to the next display message.
	Bluetooth® Wireless Technology. Shows the status of *Bluetooth* Communication.
	Electronic Solar Switch (ESS) DC load disconnection unit • ❶ When the Electronic Solar Switch is plugged in, the DC circuit is closed. • ⓪ To interrupt the DC circuit and disconnect the inverter securely under load, you must first pull out the Electronic Solar Switch ❶ and then remove all DC plug connectors ❷, as described in section 7.2 "Opening the Inverter" (page 53).

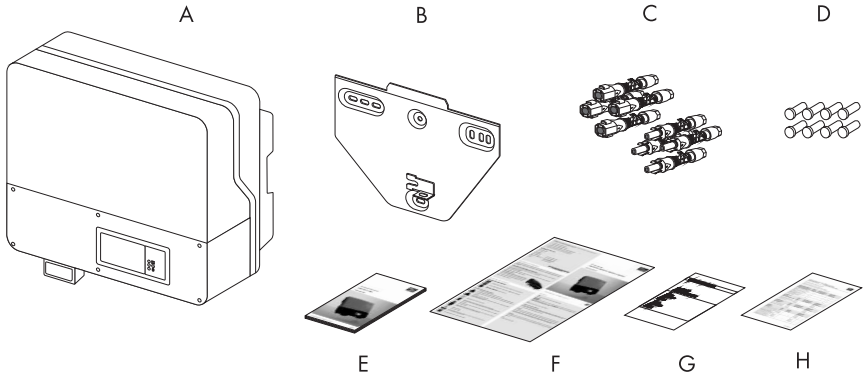
2.3.2 Symbols on the Type Label

Icon	Explanation
	Beware of dangerous electrical voltage. The inverter operates at high voltages. All work on the inverter may only be carried out by qualified personnel.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Observe all documentation that accompanies the inverter.
	The inverter must not be disposed of together with household waste. For more information on disposal, see section 12.5 "Disposing of the Inverter" (page 76).
	CE mark. The inverter complies with the requirements of the applicable EC guidelines.
	The inverter is transformerless.
	Direct Current (DC)
	Alternating current (AC)
	Protection rating IP54. The inverter is protected against dust deposits in the interior and against splashes of water from all angles.
	RAL quality mark for solar products. The inverter complies with the requirements of the German Institute for Quality Assurance and Labeling.
	Device class label. The product is equipped with a wireless component that complies with the harmonized standards.
	Certified safety The inverter complies with the requirements of the Equipment and Product Safety Act in Europe.

3 Unpacking

3.1 Scope of delivery

Check the delivery for completeness and any visible external damage. Contact your dealer if anything is damaged or missing.



Object	Number	Description
A	1	Sunny Boy
B	1	Wall-mounting bracket
C	8	DC plug connector (4 x positive, 4 x negative)
D	8	Sealing plugs for DC plug connectors
E	1	Installation Guide
F	1	User Manual
G	1	Set of documents with explanations and certificates
H	1	Supplementary sheet with inverter factory settings
optional	1	Installation Guide for communication module

3.2 Identifying the Inverter

You can identify the inverter using the type label. The type plate is on the right side of the enclosure.

The serial number (Serial no.) and the type (Type/Model) of the product, as well as device-specific characteristics are specified on the type label.

4 Mounting

4.1 Safety

DANGER!

Danger to life due to fire or explosion.

Despite careful construction, electrical devices can cause fires.

- Do not mount the inverter on flammable construction materials.
- Do not mount the inverter in areas where highly flammable materials are stored.
- Do not mount the inverter in areas with a risk of explosion.

CAUTION!

Parts of the enclosure can become hot - risk of burn injuries!

- Mount the inverter in such a way that it cannot be touched inadvertently during operation.

CAUTION!

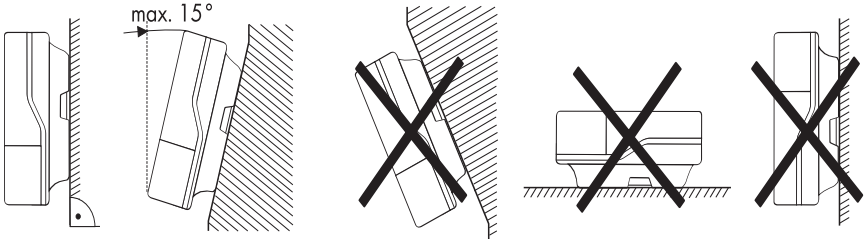
Risk of injury due to the heavy weight of the inverter.

- Take the inverter's weight of approx. 25 kg into account for mounting.

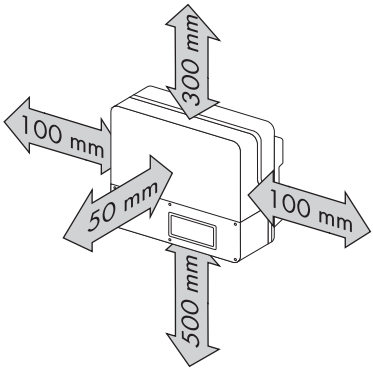
4.2 Selecting the Mounting Location

Consider the following points when selecting where to install:

- The mounting method and location must be suitable for the inverter's weight and dimensions (see section 13 "Technical Data" (page 77)).
- Mount on a solid surface.
- The mounting location must at all times be clear and have safe access without the use of additional aids such as scaffolding or lifting platforms. Any possible service actions are otherwise limited.



- Mount vertically or tilted backward by max. 15°.
- The connection area must point downwards.
- Never mount the device with a forward tilt.
- Never install the device with a sideways tilt.
- Do not mount horizontally.
- Mount at eye level to allow operating status to be read at all times.
- The ambient temperature should be below 40 °C to ensure optimal operation.
- Do not expose the inverter to direct sunlight to avoid power reduction due to excessive heating.
- In living areas, do not mount the unit on plasterboard walls or similar to avoid audible vibrations. The inverter can make noises when in use, which may be perceived as a nuisance in a living area.
- Observe the minimum clearances to walls, other inverters, or objects as shown in the diagram in order to ensure sufficient heat dissipation and sufficient space for removing the Electronic Solar Switch.



Multiple inverters installed in areas with high ambient temperatures

There must be sufficient clearance between the individual inverters to ensure the cooling air from the adjacent inverter flows freely.

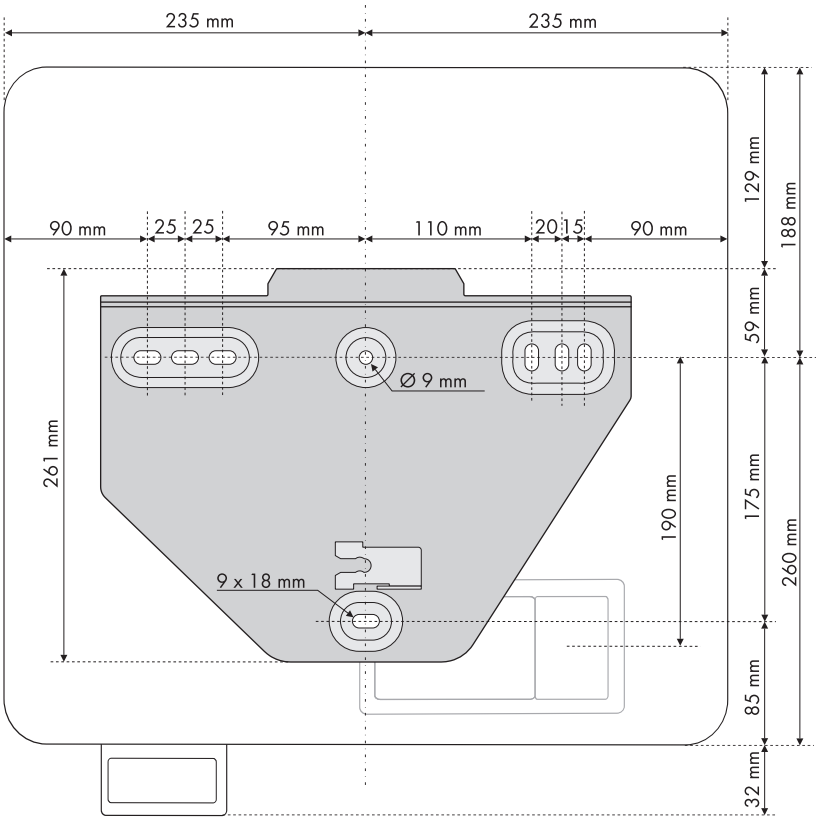
If necessary, increase the clearance spaces and make sure there is enough ventilation to ensure sufficient cooling of the inverters.

4.3 Mounting the Inverter with the Wall Mounting Bracket

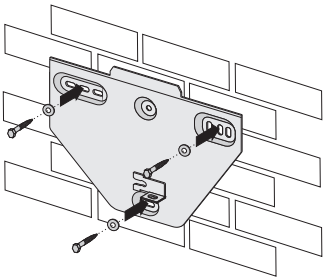
1. Use the wall mounting bracket as a drilling template and mark the positions of the drill holes.

Number of drill holes used

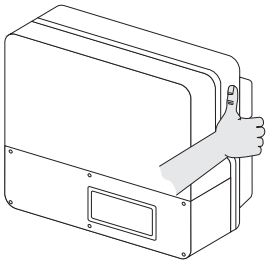
- When mounting onto the wall, use at least 2 of the horizontal holes and the lowest hole in the middle.
- Use the two holes in the center when mounting the device to a pillar.



2. Attach the wall mounting bracket using appropriate screws (diameter min. 6 mm) and washers (outer diameter min. 18 mm).

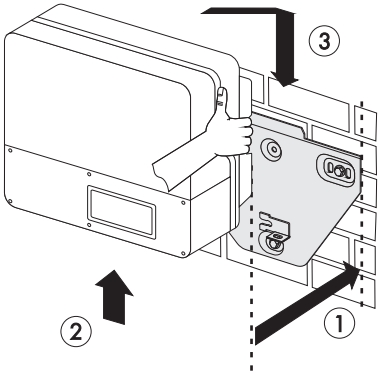


3. Transport the inverter using the grip recesses on the sides.

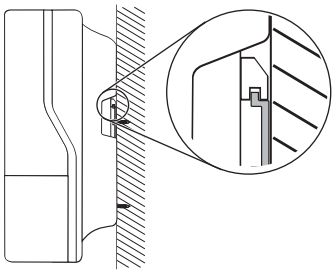


4. Attach the inverter to the wall bracket slightly to the left of its final position.

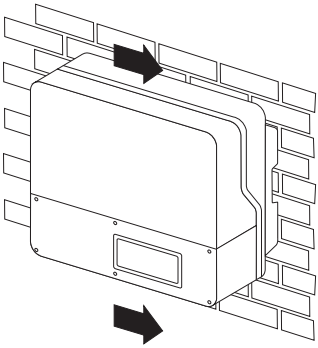
   The right edge of the rear panel of the inverter has to be flush with the right edge of the wall mounting bracket.



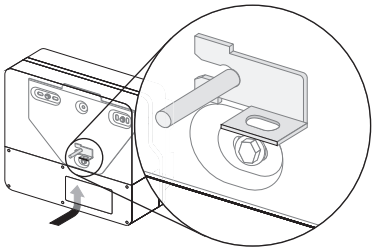
5. Check both sides of the inverter to ensure that it is correctly in place.



6. Push the inverter to the right on the wall mounting bracket, until it locks into place with the locking bolt on the back wall.



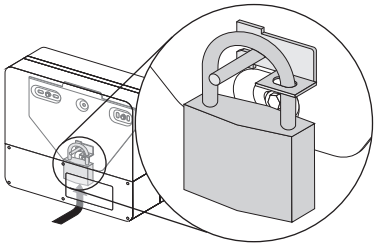
7. Check to ensure that the inverter is correctly seated.



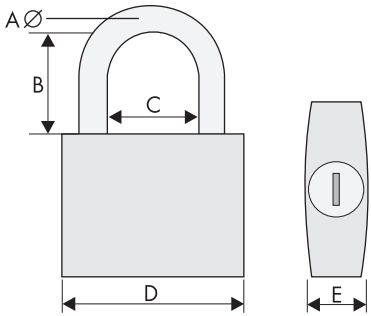
☑ The inverter is now securely mounted to the wall.

Optional Theft Protection

To protect the inverter from theft, you can lock it to the wall mounting bracket with a padlock.



The lock must meet the following requirements:



- Size:
  A: 6 mm ... 10 mm diameter
  B: 21 mm ... 35 mm
  C: 20 mm ... 33 mm
  D: 40 mm ... 60 mm
  E: 13 mm ... 21 mm
- Stainless
- Hardened shackle
- Secured lock cylinder

Storage of the key

Store the key carefully for possible service purposes.

Outdoor Installation

Always use a lock suitable for outdoor installation. Regularly check the correct function of the padlock.

4.4 Mounting the inverter with a top hat rail

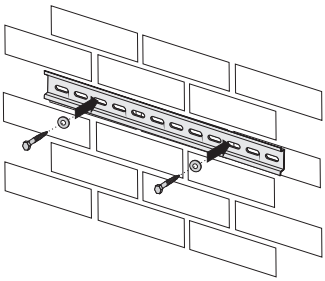
Requirements for installing the top hat rail

- Use a TH-35-7.5 supporting rail compliant with DIN EN 60715.
- Use stainless steel top hat rail and screws to prevent contact corrosion.
- Install on level ground only.
- Use fastening material suitable for the surface. Please observe the weight of the inverter.

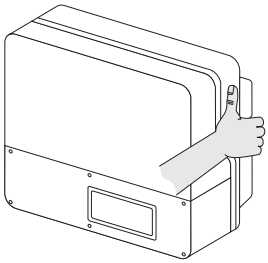
Procedure

1. Use the top hat rail as a drilling template and mark the positions of the drill holes.
2. Attach the top-hat rail using appropriate screws (diameter min. 6 mm) and washers (outer diameter min. 18 mm).

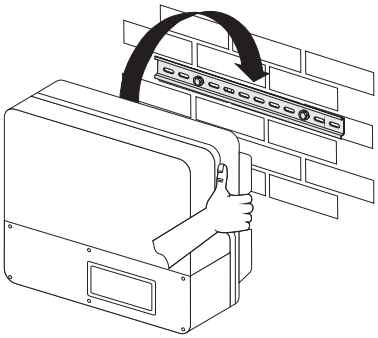
   Secure one screw at least every 300 mm.



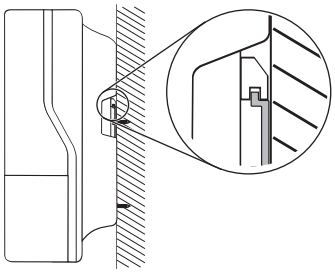
3. Transport the inverter using the grip recesses on the sides.



4. Suspend the inverter on the top hat rail using the opening on its rear wall.



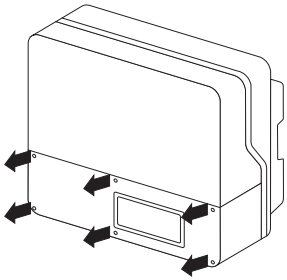
5. Check both sides of the inverter to ensure that it is correctly in place.



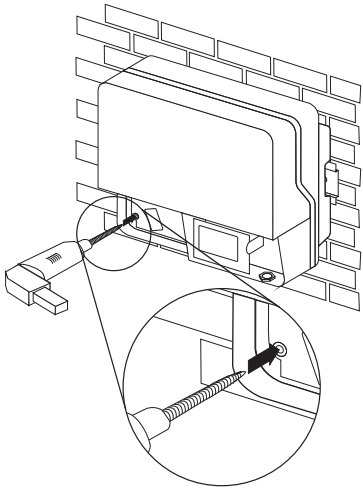
Securing the Inverter Against Excavation

Additionally secure the inverter in the wall using screws.

1. Remove the Electronic Solar Switch downwards.
2. Loosen all 6 captive screws and remove lid.



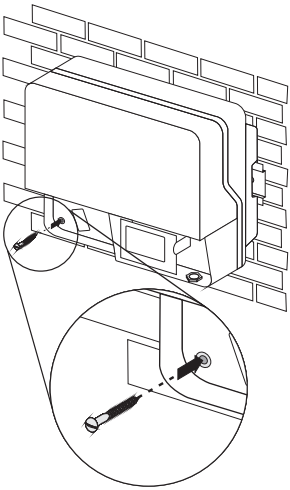
3. Drill through the back wall of the enclosure.
4. Use a suitable drill bit with a minimum length of 120 mm.
5. Insert suitable wall anchor.



6. Fasten the inverter.

   The screw must meet the following requirements:

Length:	at least 100 mm
Diameter:	8 mm
Screw head	No outside hexagon, no countersunk head



☑ The inverter is protected against excavation.

5 Electrical Connection

5.1 Safety

NOTICE!

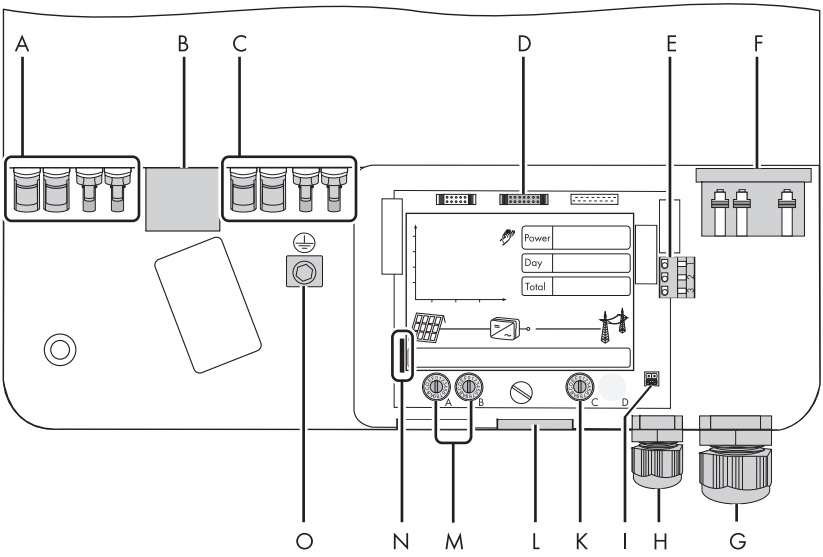
Damage to the inverter through electrostatic discharges.

Internal components of the inverter can be irreparably damaged by static discharge.

- Ground yourself before you touch a component.

5.2 Overview of the Connection Area

The following figure shows the assignment of the individual connection areas, enclosure openings and cable glands of the inverter.



Object	Description
A	DC plug connectors for connecting the strings (input zone A)
B	Electronic Solar Switch (ESS) socket
C	DC plug connectors for connecting the strings (input zone B)
D	Connector for optional communication via RS485
E	Connection terminal for multi-function relays
F	Terminals for grid connection (AC)
G	Cable gland for grid connection (AC) (12 mm ... 25 mm)
H	Cable gland (6 mm ... 12 mm) for the optional connection of the multi-function relay
I	Jumper slot for setting the language to English
K	Rotary switch for the configuration of *Bluetooth* communication
L	Enclosure opening for optional communication via RS485
M	Rotary switch to set the country of installation and the display language
N	Slot for SD card
O	Ground terminal to additionally ground the inverter

5.3 Connection to the Power Distribution Grid (AC)

5.3.1 Conditions for the AC Connection

- Comply with the connection requirements of your utility operator.

Residual current protective device

The inverter is equipped with an integrated all-pole sensitive failure current monitoring unit. The inverter can automatically distinguish between real fault currents and "normal" capacitive leakage currents.

If an external RCD or residual current breaker is strictly required, you must use a switch that triggers at a failure current of 100 mA or higher.

Cable sizing

The grid impedance of the AC cable must not exceed 1 ohm. Otherwise, the inverter will disconnect at full feed capacity due to excessive voltage at the feed-in point.

The conductor cross-section should be dimensioned such that cable losses do not exceed 1 % at nominal power. Use "Sunny Design" (www.SMA.de/en/SunnyDesign) for this.

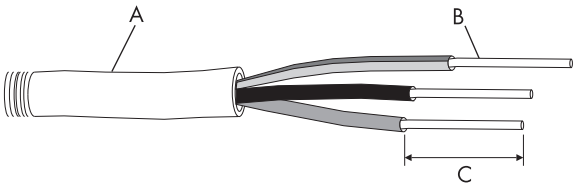
The maximum cable lengths relative to the conductor cross-section are shown in the following table.

Conductor cross-section	Max. cable length
4.0 mm²	16 m
6.0 mm²	23 m
10.0 mm²	39 m

The conductor cross-section required in individual cases depends on the following factors, among others:

- Ambient temperature,
- Routing method,
- Cable losses,
- Valid installation requirements of the respective country (installation location).

Cable Requirements



Object	Description	Value
A	External diameter	12 mm ... 25 mm
B	Cross-section of insulated conductor	Max. 10 mm²
C	Strip insulation	Approx. 12 mm

Load disconnection unit

You must install a **separate** line circuit breaker for each inverter in order to ensure that the inverter can be securely disconnected under load. The maximum permissible rating is located in section 13 "Technical Data" (page 77).

Detailed information and examples for the design of a line circuit breaker can be found in the Technical Information "Miniature Circuit Breaker" in the SMA Solar Technology AG download area at www.SMA.de/en.

DANGER!

Danger to life due to fire.

When more than one inverter is connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed. It can result in a cable fire or the destruction of the inverter.

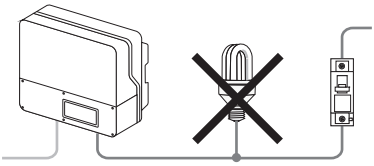
- Never connect several inverters to the same line circuit breaker.
- Observe the maximum permissible fuse protection of the inverter when selecting the line circuit breaker.

DANGER!

Danger to life due to fire.

When a producer (inverter) and a consumer are connected to the same line circuit breaker, the protective function of the line circuit breaker is no longer guaranteed. The current from the inverter and the grid can accumulate to overcurrent which is not be detected by the line circuit breaker.

- Never connect consumers between the inverter and the line circuit breaker without protection.
- Always protect consumers separately.



NOTICE!

Damage to the inverter by using screw type fuse elements as a load disconnection unit.

A screw type fuse element, e.g. D system (Diazed) or D0 system (Neozed) is not a load disconnection unit, and thus must **not** be used as a load disconnection unit. A screw type fuse element is only used as cable protection.

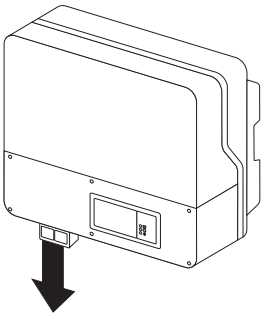
When disconnecting under load using a screw type fuse element, the inverter can be damaged.

- Use only a load disconnection switch or a line circuit breaker as a load disconnection unit.

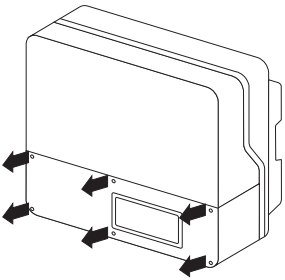
5.3.2 Connecting the Inverter to the Public Grid (AC)

1. Check that the grid voltage is within the permissible voltage range.

   The exact operating range of the inverter is specified in the operation parameters. The corresponding document is located in the download area at www.SMA.de/en, in the "Technical Description" category of the respective inverter.
2. Disconnect the line circuit breaker and secure against re-connection.
3. Remove the Electronic Solar Switch.

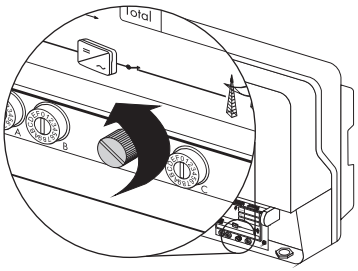


4. Loosen all 6 captive screws and remove lid.

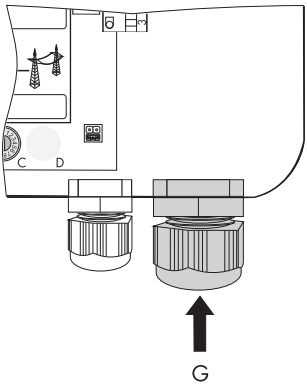


5. Check the correct country setting of the inverter using the supplement provided against the factory settings.

   If the inverter is not set to the desired country standard, then adjust the country standard as described in section 5.5.2 "Setting the Country Standard and Language using Rotary Switches" (page 44).
6. For easy connection, loosen the display screws until the display raises.
   - Flip up the display until it clicks into place.

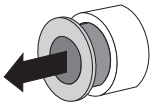


7. Unscrew the AC cable gland's lock nut (G) and remove the filler-plug from the cable gland.



Seal in the AC cable gland

There is a two-part seal in the cable gland. Remove the internal insert if necessary, e.g. to lay a thicker cable.



The following guideline values apply:

- Cable cross-section with seal and insert: 12 mm ... 16 mm
- Cable cross-section with seal only and without insert: 15 - 21 mm

8. Pull the cable through.
9. Raise the AC clamp terminals as far as they will go.

NOTICE!

Risk of fire when connecting 2 conductors to a single terminal

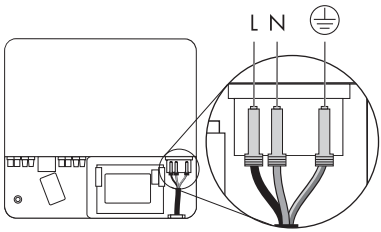
If 2 conductors are connected to one terminal, a poor electrical contact can result in overheating or a risk of fire.

- Never connect more than one conductor per terminal.

10. Connect L, N and the protective conductor (PE) to the AC terminal in accordance with the label.

    To do this, the insulated PE conductor must be 5 mm longer than the insulated L and N conductors!

    L and N must not be swapped.



CAUTION!

Danger of crushing when terminals snap shut!

The terminals close by snapping down fast and hard.

- Press the terminals down with your thumb, do not grip the entire terminal on all sides.
- Keep fingers away from the terminals.

11. Close all terminals of the AC terminal again until they snap into place.
12. Fold down the display and screw it tightly.
13. Tighten the lock nut firmly to the cable gland.

DANGER!

Danger to life due to high voltages in the inverter.

- Do not switch on the line circuit breaker until the PV generator has been connected and the inverter is securely closed.

☑ The inverter is now connected to the public grid (AC).

5.3.3 Additional Grounding of the Enclosure

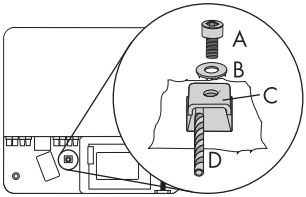
If a second protective conductor connection is required in the country of installation, you can also ground the inverter using a second protective conductor on the connection terminal on the enclosure.

Procedure

1. Undo screw (A) by half way.
2. Insert the stripped grounding cable (D) under the clamping clip (C) (max. cross-section 16 mm²).
3. Fasten terminal (C).

   The toothing of the lock washer (B) must face toward the terminal clamp.

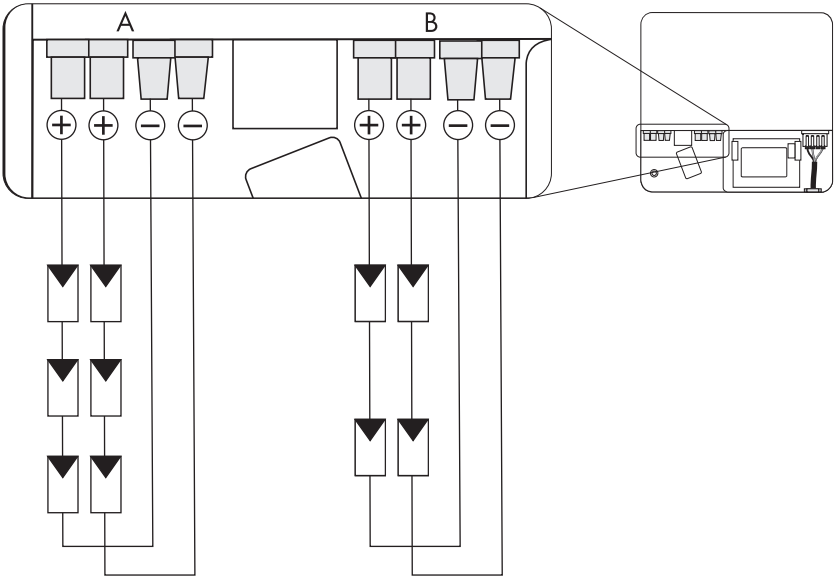
☑ The inverter's enclosure is additionally grounded.



5.4 Connection of the PV Generator (DC)

5.4.1 Conditions for the DC connection

The inverter has two input zones "A" and "B", each with its own MPP tracker. 2 strings can be connected to each input zone.



Use of Adaptors

Adaptors (branch connectors) must not be visible or freely accessible in the immediate surroundings of the inverter.

- The DC circuit may not be interrupted by adaptors.
- Observe the procedure for disconnecting the inverter as described in section 7.2 "Opening the Inverter" (page 53).

- For each input zone (A or B), the following are the requirements for the PV modules of the connected strings:
  - Same type
  - Same number
  - Identical alignment
  - Identical tilt
- When connecting just 2 identical strings, it is more efficient to connect these to only one input zone also.

  Exception: shaded strings or if the total input current is more than 15 A.

No mixed connections between input zones

For instance, if the positive pole of a string is connected at input zone A and the negative pole at input zone B, this is called a mixed connection.

Only connect strings at one input zone and never mix the input zones A and B!

Otherwise, the inverter no longer fulfills the requirements of the EMC Directive (Directive on the **e**lectro**m**agnetic **c**ompatibility of a device) and therefore loses its operation license.

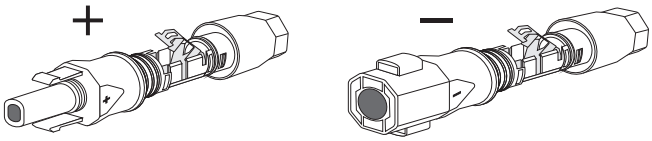
- The connecting cables of the PV modules must be fitted with plug connectors. You will find the necessary DC plug connector for DC connection in the delivery.
- The following limit values at the DC input of the inverter must not be exceeded:

maximum input voltage	Maximum input current	
	Input area A	Input area B
550 V	15.0 A	15.0 A

5.4.2 Assembling the DC plug connector

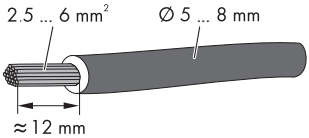
In order to connect to the inverter, all connection cables of the PV modules must be equipped with the DC plug connectors provided.

To assemble the DC plug connectors, proceed as follows: Ensure the plug connectors have the correct polarity. The DC plug connectors have the symbols "+" and " – ".



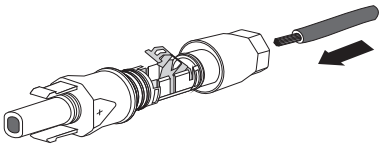
Cable Requirements

- Use a PV1-F cable.

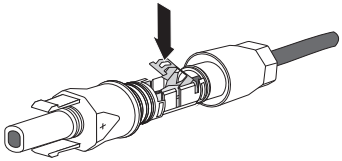


Procedure

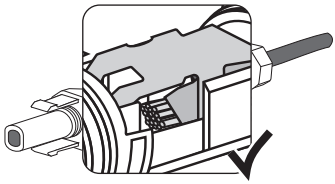
1. Insert the stripped cable into the plug up to the limit.

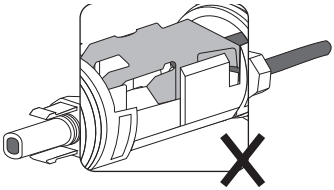
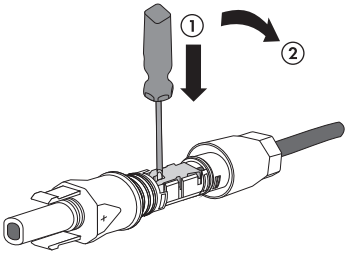


2. Press the clamping clip down until it audibly snaps into place.

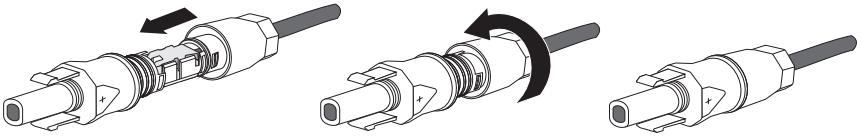


3. Ensure the cable is correctly in place.

Result	Measure
☑ If the conductors are visible in the hollow cavity of the clamping clip, the cable is in the correct position. 	• Proceed to step 4.

Result	Measure
☑ If the conductors are **not** visible in the hollow cavity, the cable is not in the correct position. 	• Loosen the clamping bracket with the help of a screwdriver. The width of the screwdriver should be 3.5 mm.  • Remove cable and start again from step 1.

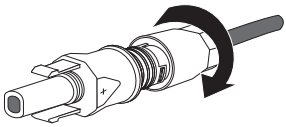
4. Push the threaded joint to the thread and screw into place with a torque of 2 Nm.



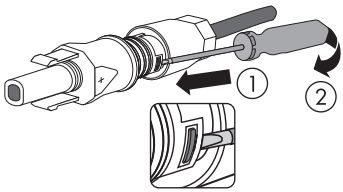
☑ The DC connectors are now assembled and can be connected to the inverters, as described in section 5.4.4 "Connecting the PV Generator (DC)" (page 37).

5.4.3 Opening the DC Plug Connector

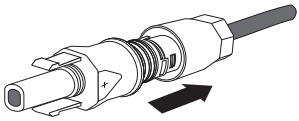
1. Screw the threaded joint off.



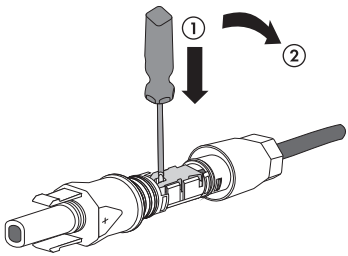
2. To release the plug connector, slot a screw driver into the side catch mechanism and lever out. The width of the screwdriver should be 3.5 mm.



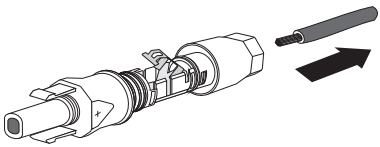
3. Carefully pull the DC connector apart.



4. Loosen the clamping bracket with the help of a screwdriver. The width of the screwdriver should be 3.5 mm.



5. Remove the cable.



☑ The cable is now removed from the DC plug connector.

5.4.4 Connecting the PV Generator (DC)

DANGER!

Danger to life due to high voltages in the inverter.

- Before connecting the PV generator, ensure that the line circuit breaker is switched off and that it cannot be reactivated.

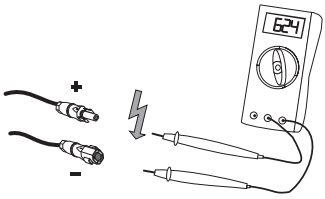
NOTICE!

Excessive voltages can destroy the measuring device!

- Only use measuring devices with a DC input voltage range up to at least 1,000 V.

1. Check the connection cables of the PV modules for correct polarity and make sure that the maximum input voltage of the inverter is not exceeded.

   At an ambient temperature above 10 °C, the open circuit voltage of the PV modules must not be more than 90 % of the maximum inverter input voltage. Otherwise, check the system design and the PV module connection. If this is not done, the maximum inverter input voltage can be exceeded at low ambient temperatures.



NOTICE!

Destruction of the inverter due to overvoltage.

If the voltage of the PV modules exceeds the maximum input voltage of the inverter, it can be destroyed by the overvoltage. All warranty claims become void.

- Do not connect strings with an open circuit voltage greater than the maximum input voltage of the inverter.
- Check the system design.

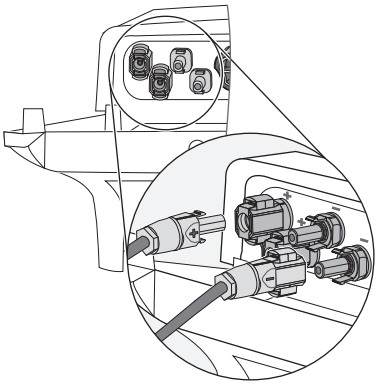
2. Check the strings for ground faults, as described in section 11.1 "Checking the PV Generator for a Ground Fault" (page 68).

DANGER!

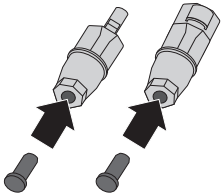
Risk of lethal electric shock.

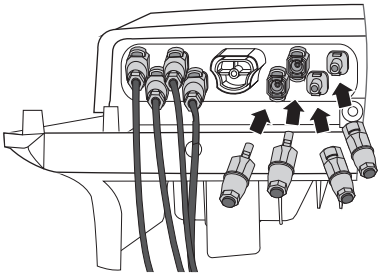
- Do not connect strings with ground faults.
- First, rectify the ground fault in the respective string.

3. Check the DC connector for correct polarity and connect it. To release the DC connectors see section 7.2 "Opening the Inverter" (page 53).



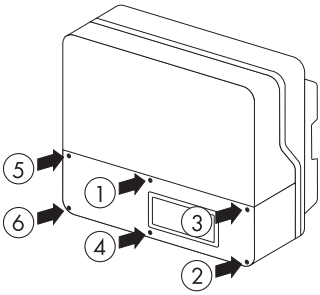
4. To create the sealing on the inverter, all the DC inputs have to be closed as follows:
   - Insert the provided sealing plugs into the unneeded DC plug connectors.
     Do **not** insert the sealing plugs into the DC inputs on the inverter.
   - Insert the DC plug connectors with sealing plugs into the corresponding DC inputs on the inverter.



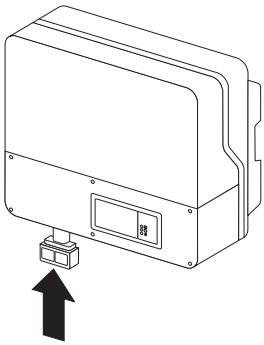


5. Close the lid again using the 6 screws.

   Tighten the screws with 1.4 Nm torque in the order shown in the figure on the right.



6. Check the Electronic Solar Switch for wear, as described in section 8.2 "Checking the Electronic Solar Switch (ESS) for Wear" (page 58) and attach it firmly.



NOTICE!

Damage to Electronic Solar Switch.

If it is not correctly connected, the Electronic Solar Switch can be damaged.

- Plug the handle firmly onto the socket of the Electronic Solar Switch.
- The holder must close flush with the enclosure.
- Check that the handle is securely in place.

☑ The PV generator is now connected.

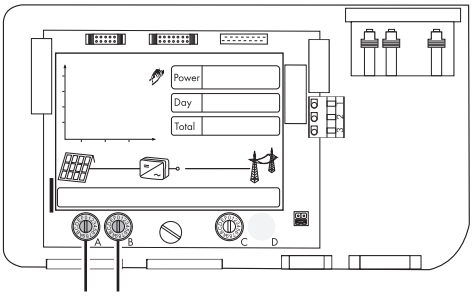
You can now commission the inverter as described in section 6 "Commissioning" (page 50). Other connection options are optional (see section 5.6 "Communication" (page 45)).

5.5 Setting the Country Standard and Display Language

The inverter can be configured for various countries. This is carried out via the two rotary switches in the inverter before commissioning or via the configuration of the "CntrySet" or "Set country standard" parameters via a communication device (z. B. Sunny WebBox or Sunny Explorer) once you have commissioned the inverter.

The switch position 0 / 0 indicates the delivered state. If you have ordered the inverter with specific country settings, these will have already been preset in the factory via a communication device. In this case, you will not be able to recognize the setting by the switch position. If changes are made via the rotary switches or via a communication device, the default grid parameters are overwritten. They cannot be restored, but have to be re-entered via a communication device. The display language can be changed anytime independently of the grid parameters using the rotary switches. In this way, the default grid parameters remain unchanged, but the display messages are shown in the set language. For devices ordered without any specified country of installation, the standard setting is "VDE0126-1-1" and the language is "German".

Changes will be immediately accepted after switching the line circuit breaker on. If an unprogrammed switch setting is selected, the inverter issues an error message on the display and the last valid setting is retained.



Switch A Switch B

SMA Grid Guard Protected Country Data Sets

In some countries, the local power supply line requirements demand a mechanism which prevents the parameters for grid feeding from being able to be changed. Some country data sets are therefore protected and can only be unlocked with a personal access code, the so-called SMA Grid Guard Code.

SMA Grid guard protected country data sets are automatically blocked for 10 feed-in hours after commissioning, or after the last alteration. If the country data set is changed after these 10 feed-in hours, the inverter will not accept the changes and displays the error message "Grid parameter locked". If, however, a later change to the country data set only relates to a change of the display language via the rotary switches in the inverter, this change is immediately taken on.

It is also possible to set country data sets (parameter "CntrySet" and/or "Set country standard"), and to lock or unlock these manually via a communication device. To lock, you have to enter the digit sequence "54321" instead of the password into the SMA Grid Guard Code field. The data set can only be unlocked by entering a personal, 10-digit SMA Grid Guard Code which is valid for a maximum of 10 grid-feed hours. The application form for the personal access code is located in the download area at www.SMA.de/en, in the "Certificate" category for each inverter. The language is configurable without a password independent of the country data set.

Changing of parameters in SMA Grid Guard protected country data sets

If the parameters within protected country data sets are changed, these are no longer protected and instead of the standard, "ADJ" or "Special setting" is displayed. In this case, the parameters are not changed automatically after 10 grid-feed hours, but have to be manually locked. To manually lock the parameters, set the SMA Grid Guard Code to "54321".

Further information on parameter settings

Detailed information on how to proceed with respect to setting and changing parameters is available in the respective User Manual for your software.

The last change (executed via rotary switch or communication device) is always verified and activated if applicable. Consequently, the switch position may not necessarily show the actual country configuration.

5.5.1 Checking the Country Standard

Check whether the inverter is set to the installation country.

Before commissioning:

- Check that the country setting of the inverter is correct using the supplement provided and comparing this to the the factory settings of the inverter.

After commissioning:

- Check that the country standard is correct on the basis of the display message during (re-)commissioning (see section 6 "Commissioning" (page 50)).

  or

- Check that the country standard is correct on the basis of the "SMA grid guard" measuring channel via a communication device.

Display language

Once you have set the country standard, you can always set the display language later using rotary switch B. However, you have to then set the rotary switch A to "0" in order to keep the country data set.

The settings of each country data set are specified in the operation parameters. The parameters can be read out using a communication device. The description of the operating parameter is available in the download area at www.SMA.de/en in the category "Technical Description" of the respective inverter.

(A)	(B)	Country data set	Display language	Grid guard protection	Country
0	0	Delivery state	Delivery state	Dependent on parameter set	Dependent on parameter set
0	1	Retained	English	Dependent on parameter set	Dependent on parameter set
0	2	Retained	German	Dependent on parameter set	Dependent on parameter set
0	3	Retained	French	Dependent on parameter set	Dependent on parameter set
0	4	Retained	Spanish	Dependent on parameter set	Dependent on parameter set
0	5	Retained	Italian	Dependent on parameter set	Dependent on parameter set
0	6	Retained	Not used*	Dependent on parameter set	Dependent on parameter set
0	7	Retained	Not used*	Dependent on parameter set	Dependent on parameter set
5	8	G83/1-1	English	No	England

(A)	(B)	Country data set	Display language	Grid guard protection	Country
6	0	EN50438	German	Yes	Various EU countries
6	1	EN50438	English	Yes	Various EU countries
6	2	EN50438	French	Yes	Various EU countries
6	3	EN50438	Italian	Yes	Various EU countries
6	4	EN50438	Spanish	Yes	Various EU countries
6	5	EN50438	Not used*	Yes	Various EU countries
6	6	EN50438	Not used*	Yes	Various EU countries
C	0	Customer	English	No	Flexibility
C	1	Customer	German	No	Flexibility
C	2	Customer	French	No	Flexibility
C	3	Customer	Spanish	No	Flexibility
C	4	Customer	Italian	No	Flexibility
C	5	Customer	Not used*	No	Flexibility
C	6	Customer	Not used*	No	Flexibility

a) Special setting: *Bluetooth* transmission power reduced (in accordance with French standards)

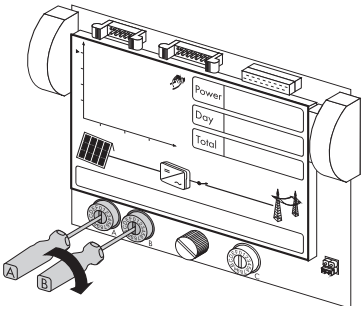
*) Currently not used. The previously configured display language remains set.

Should the inverter not be set to the installation country, you have several options to configure the country standard required.

- Setting via 2 rotary switches, as described in section 5.5.2 "Setting the Country Standard and Language using Rotary Switches" (page 44).
- Alternatively you can conduct the settings via the "CntrySet" or "Set country standard" parameters with a communication device, once you have commissioned the inverter.
- If you require adjusted parameter settings for your installation location, you can change these with the help of a communication device.

5.5.2 Setting the Country Standard and Language using Rotary Switches

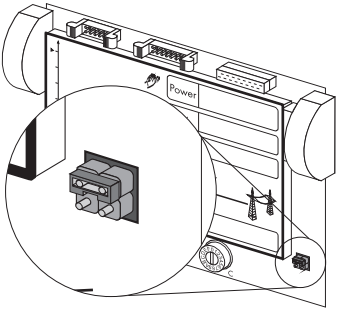
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).
2. Set the arrows on both rotary switches (A and B) using a screwdriver to the desired positions (see table in section 5.5.1 "Checking the Country Standard" (page 42)). Use a screwdriver with a width of 2.5 mm.



Jumper for English language

You can also set the language to English by means of a jumper (e.g. for service purposes).

- To do so, plug the jumper onto the upper two pins as shown on the right.



3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 56).

5.6 Communication

5.6.1 Bluetooth

Communication via *Bluetooth* with a communication device is activated as standard. Networking via *Bluetooth* with other inverters is deactivated ex works.

The following configuration settings are possible via a rotary switch (switch C):

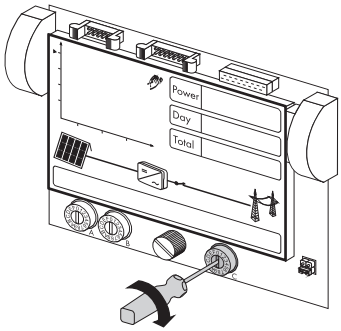
Switch position (NetID)	**Setting**
0	Off
1	Communication via *Bluetooth* with communication device possible, no networking with other inverters (factory setting)
2 ... F	Networking with other inverters

In order to restrict communication via *Bluetooth* between the inverters of your system and those of neighboring systems, you can assign an individual NetID to the inverters of your system (switch position 2 ... F). This, however, is only necessary if neighboring systems are within a radius of 500 m.

So that all inverters in your system are detected by your communication device, all inverters must have the same NetID.

Procedure

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).
2. Set the arrow on the rotary switch (C) to the required position using a screwdriver (2.5 mm). Use a screwdriver with a width of 2.5 mm.
3. Close the inverter as described in section 7.3 "Closing the Inverter" (page 56).



Acceptance of settings

The *Bluetooth* settings will first be accepted upon commissioning the inverter.

5.6.2 Multi-function relay

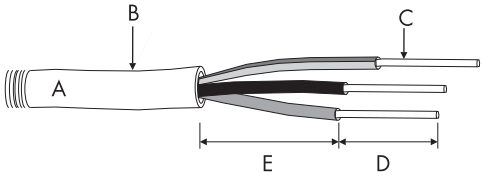
The inverter is equipped with a multi-function relay as standard. This can be activated simultaneously with the red error LED beside the display. Other functions of the multi-functional relay are outlined in the Technical Description "Multi-functional relay and OptiTrac Global Peak" in the download area at www SMA de. These additional functions can be later retrofitted via a firmware update.

Here you can connect separate loads both in the event of errors and for trouble-free operation.

The following table contains the maximum permissible voltages and currents:

	Voltage	Electricity
AC	Max. 240 V	Max. 1.0 A
DC	Max. 30 V	Max. 1.0 A

Cable Requirements



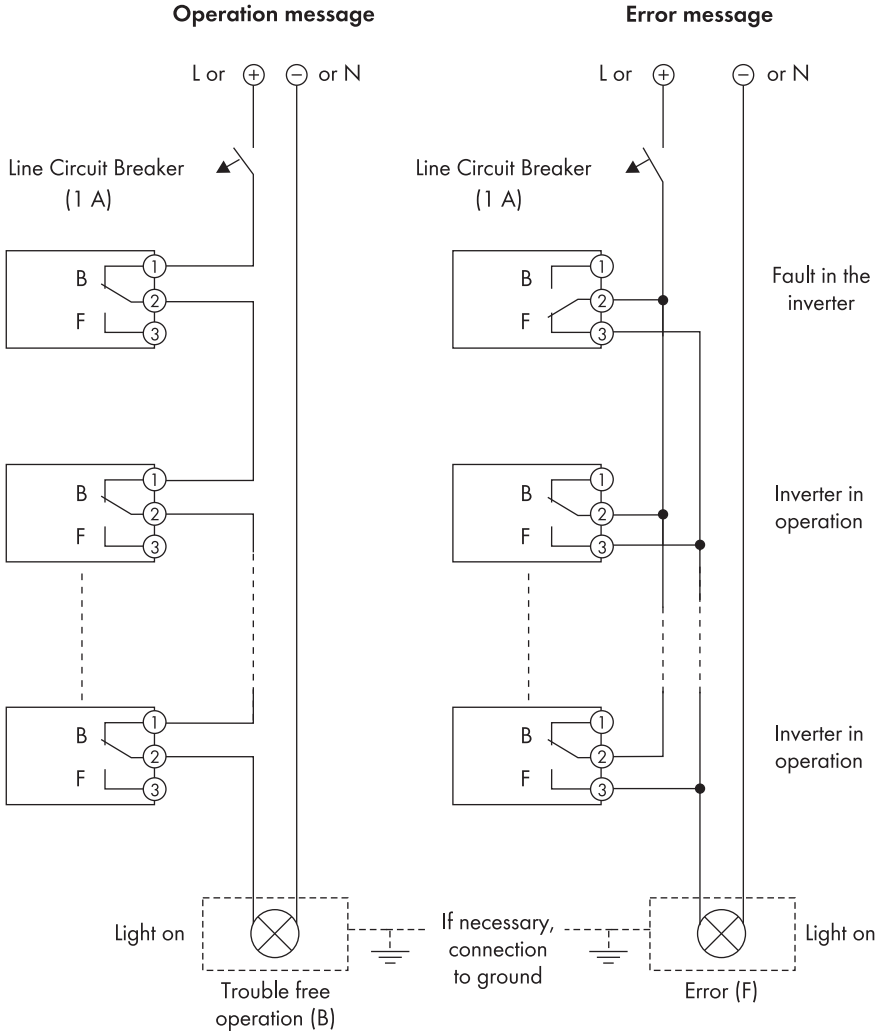
Object	Description	Value
A	Cable type	Double insulated
B	External diameter	5 mm ... 12 mm
C	Cross-section of insulated conductor	0.08 mm² ... 2.5 mm²
D	Strip insulation	max. 8 mm
E	Stripping length	max. 15 mm

The cable type and cable-laying method must be appropriate to the application and location.

Line circuit breaker

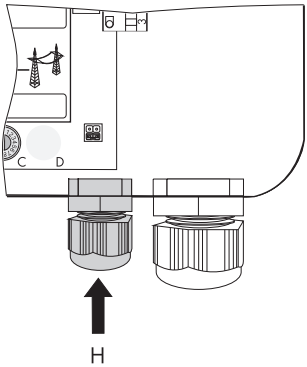
If you are connecting the multi-function relay to the public grid, it must be protected with a separate line circuit breaker.

Connection plan



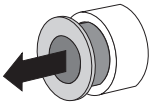
Connection procedure

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).
2. Loosen the cable gland's lock nut (H) slightly and remove the filler-plug from the cable gland.



Seal in the cable gland

There is a two-part seal in the cable gland. Remove the internal insert if necessary, e.g. to lay a thicker cable.



The following guideline values apply:

- Cable diabmeter with seal and insert: 5 mm ... 7 mm
- Cable diameter with seal and without insert: 7 mm ...13 mm

DANGER!

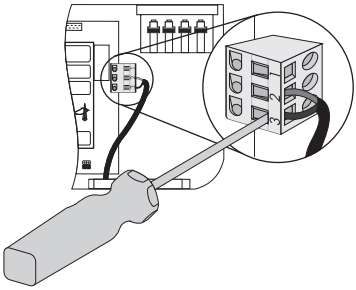
Danger to life due to high voltages in the inverter.

- Do not use cables with single-layer insulation.
- Strip cable to a maximum length of 15 mm.

3. Insert the cable into each inverter.
4. Strip max. 8 mm off the insulated conductors.

5. Connect wires to the terminal using a screwdriver.

   The connection plan shows where the wires must be connected, depending on whether you require an operating or an error message.



6. Tighten the lock nut firmly to the cable gland.
7. Close the inverter as described in section 7.3 "Closing the Inverter" (page 56).
8. Switch on supply voltage

☑ The multifunction relay is now operational.

5.6.3 Communication module

The inverter can be equipped with a communication module in order to engage in wire-linked communication with special data acquisition devices (e.g. Sunny WebBox) or a PC with corresponding software (e.g. Sunny Data Control).

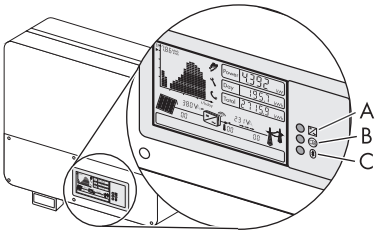
A detailed circuit diagram and installation description can be found in the communication module manual.

6 Commissioning

6.1 Commissioning the Inverter

1. Check the following requirements before commissioning:
   - Correct installation (see section 4.3 or section 4.4)
   - Correct country configuration (see section 5.5.1).
   - Correct connection of the AC cable (grid)
   - Correct connection of protective earth
   - Complete connection of all DC cables (PV strings)
   - Unnecessary DC inputs are closed with the corresponding DC connectors and sealing plugs.
   - All enclosure openings are closed.
   - The enclosure lid is securely screwed in place
   - Electronic Solar Switch is securely plugged
   - Correct installation of AC distribution
   - The line circuit breaker is laid out correctly
2. Switch on the line circuit breaker.
3. If connected, switch on the multi-function relay power supply.
4. Check whether the display and LEDs are indicating a normal operating state.

LED	Color	Description
A	Green	Glowing: operation
		Flashing: The network connection conditions have not yet been reached Wait for sufficient irradiation.
B	Red	Disturbance
C	Blue	*Bluetooth* communication is active



☑ Successful commissioning is indicated by a glowing or blinking green LED.

The meaning of the illuminated red LED and the meaning of the event numbers on the display are described in section 10.2 "Error messages" (page 61).

6.2 Display Messages during Initialization

Display messages

The display messages shown in this section serve as examples and can, depending on the country setting, differ from the display messages of your inverter.

- Firstly, the firmware version of the internal processors appears in the text lines.

- After an interval of 5 seconds, or after tapping on the enclosure lid, the serial number (or the description of the inverter) and the NET ID for communication via *Bluetooth* will appear. The description of the inverter can be changed with a communication device.

- After a further 5 seconds, or when you tap again, the configured country standard is displayed (example: "VDE0126-1-1").

- After a further 5 seconds, or when you tap again, the configured language is displayed (example: "Language German").

- During normal operation, the text line of the display will subsequently be clear. See section 10 ”Messages” (page 60) for possible event messages which may be displayed in the text line, and their meaning.

7 Opening and closing

7.1 Safety

DANGER!

Danger to life due to high voltages in the inverter.

Observe the following points before opening the inverter:

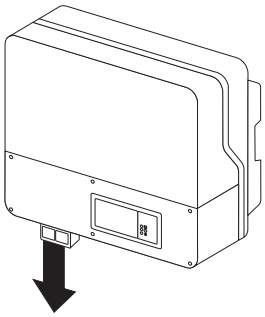
- Disconnect the line circuit breaker and secure against re-connection.
- If it is connected, switch off the power supply to the multifunction relay and prevent it from switching back on.

DANGER!

Risk of lethal electric shock.

If the DC plug connectors are pulled out without first disconnecting the Electronic Solar Switch, a dangerous electric arc can occur.

- Remove the Electronic Solar Switch first.
- Then open the lid and disconnect the DC connectors.



NOTICE!

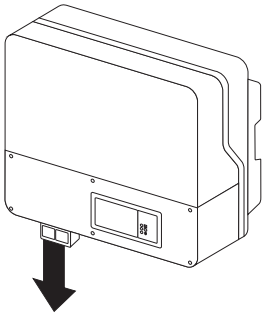
Damage to the inverter through electrostatic discharges.

Internal components of the inverter can be irreparably damaged by electrostatic discharge.

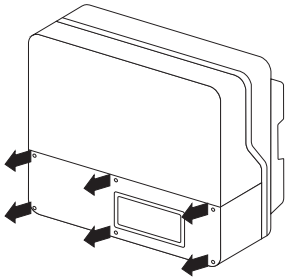
- Ground yourself before you touch a component.

7.2 Opening the Inverter

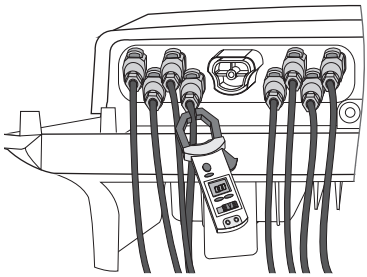
1. Disconnect the line circuit breaker and secure against re-connection.
2. If it is connected, switch off the power supply to the multifunction relay and prevent it from switching back on.
3. Remove the Electronic Solar Switch.



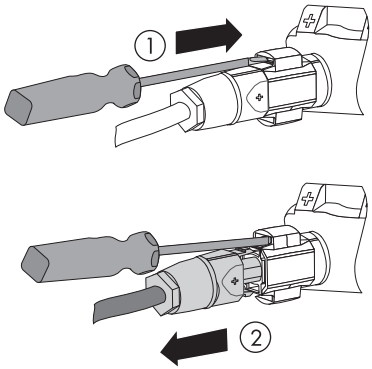
4. Loosen all 6 captive screws and remove the lower lid.



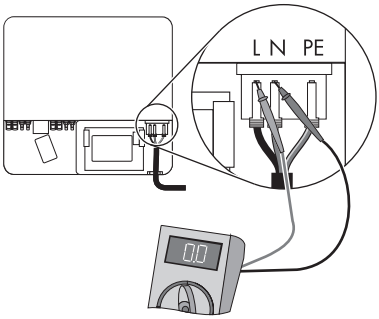
5. Using a current probe, ensure that there is no current to all DC cables.
   ☑ If there is a current present, check the installation.



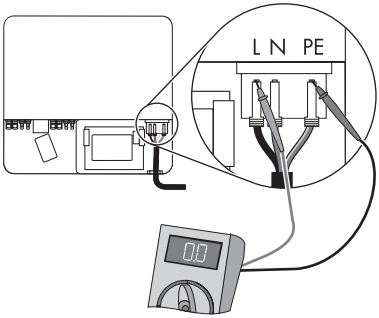
6. Unlock and disconnect all DC connectors using a 3.5 mm screwdriver:
   - Insert a screwdriver into one of the side slots (1).
   - Disconnect DC plug connectors (2).



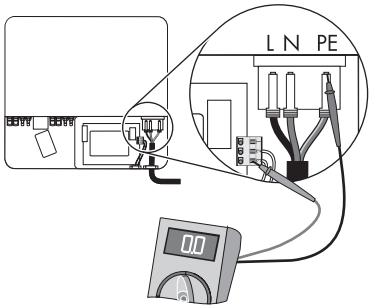
7. Wait until the LEDs, display and, if applicable, fault indicator have gone out.
8. Verify the absence of voltage L with respect to N at the AC terminal with an appropriate meter.
   ☑ If there is a voltage present, check the installation.



9. Verify the absence of voltage L with respect to PE at the AC terminal with an appropriate meter.
   ☑ If there is a voltage present, check the installation.



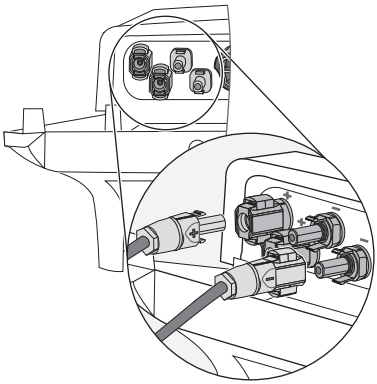
10. Verify the absence of voltage to ground at the multifunction relay.
    ☑ If there is a voltage present, check the installation.



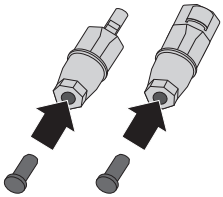
☑ The inverter is now open and free of voltage.

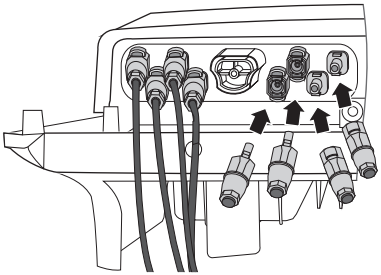
7.3 Closing the Inverter

1. Check the DC plug connectors for correct polarity and connect them to the inverter. To release the DC connectors see section 7.2 "Opening the Inverter" (page 53).



2. To create the sealing on the inverter, all the DC inputs have to be closed as follows:
   - Insert the provided sealing plugs into the unneeded DC plug connectors.
     Do **not** insert the sealing plugs into the DC inputs on the inverter.
   - Insert the DC plug connectors with sealing plugs into the corresponding DC inputs on the inverter.



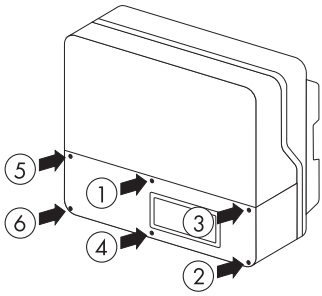


DANGER!
Risk of lethal electric shock.

- Only connect the Electronic Solar Switch when the lid is closed.
- Only operate the inverter when the lid is closed so that the DC plug connectors cannot be disconnected easily.

3. Close the lower lid with the 6 screws.

   Tighten the screws with 1.4 Nm torque in the order shown in the figure on the right.



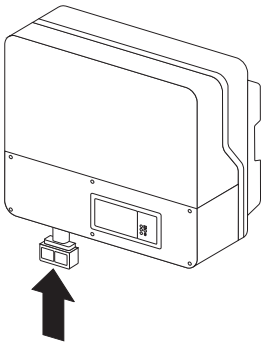
4. Check the Electronic Solar Switch for wear, as described in section 8.2 "Checking the Electronic Solar Switch (ESS) for Wear" (page 58).

NOTICE!

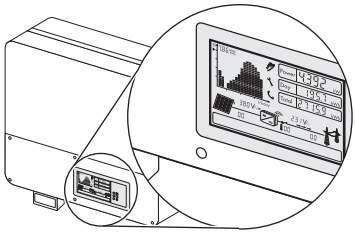
Damage to the Electronic Solar Switch by incorrect connection.

- Firmly connect the Electronic Solar Switch.
- Check firm position of the Electronic Solar Switch.

  The handle of the Electronic Solar Switch must be flush with the enclosure.



5. If connected, switch on the multi-function relay power supply.
6. Switch on the line circuit breaker.
7. Check whether the display and the LEDs indicate normal operating mode (see section 6 "Commissioning" (page 50)).



☑ The inverter is now closed and in operation.

8 Maintenance and cleaning

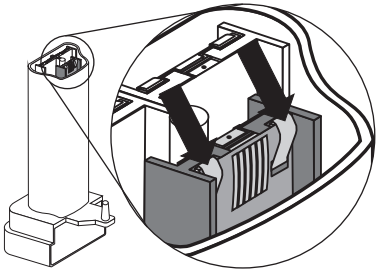
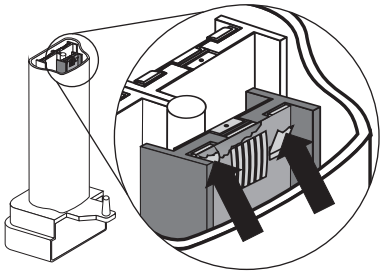
8.1 Checking Heat Dissipation

If the inverter regularly reduces its output due to too high warming (temperature symbol on the display illuminates), this can be caused by the following:

- The cooling fins on the rear side of the enclosure are clogged with dirt.
  - Clean the cooling fins with a soft brush.
- The ventilation ducts at the top are clogged with dirt.
  - Clean the ventilation ducts with a soft brush.

8.2 Checking the Electronic Solar Switch (ESS) for Wear

Check the Electronic Solar Switch for wear before plugging it in.

Result	Measure
☑ The metal tongues inside the connector are not damaged or discolored. 	• Insert the handle of the Electronic Solar Switch securely in the socket on the underside of the enclosure. • Re-commission the inverter as described in section 6 "Commissioning" (page 50).
☑ The metal tongues inside the connector have a brown discoloration or are burned out. 	The Electronic Solar Switch can no longer safely disconnect the DC side. • Replace the Electronic Solar Switch handle before attaching it again (for the order number see section 14 "Accessories" (page 81). • Re-commission the inverter as described in section 6 "Commissioning" (page 50).

9 Slot for SD card

The SD card is used to read in files, if, under consultation with the SMA Service Line, a firmware update is necessary.

SMA Solar Technology AG will send you a file with the firmware update by email or on an SD card or will make the file available in the download area at www.SMA.de/en.

You will find the description of the firmware update in the download area at www.SMA.de/en.

Properties of the SD Card

Use an SD card that is FAT16 or FAT32 formatted and has a maximum storage capacity of 2 GB.

Use the SD card exclusively for this inverter. Do not save any multimedia files or other unsuitable files on the SD card.

10 Messages

No display in the event of insufficient DC voltage

Measurements and the issuing of messages are only possible when there is sufficient DC voltage.

10.1 Event messages

During an update, the relevant display message is shown in the text line of the display.

Display	Description
< Avvio Autotest >	Only relevant for an installation in Italy: start the self-test by tapping on the display according to DK 5940 (see section 7 "Opening and closing" (page 52)).
< Inst. code valid >	The SMA guard grid code entered is valid. The configured country data set is now unblocked and can be changed. If the configured country data set is protected, the unlocking is valid for a maximum of 10 feed-in hours.
< No new update SDcard >	There is no update file relevant for this inverter on the SD card or the available update has already been carried out.
< Grid param.unchanged >	The selected switch setting is not programmed or there is no country data set available on the SD card.
< Parameters set successfully >	A new country data set has been configured.
< SD card is read >	The inverter is currently reading the SD card.
< Set parameter >	The inverter sets the parameters.
< Update completed >	The inverter has successfully completed the update.
< Update Bluetooth >	Successful update of the *Bluetooth* components.
< Update display >	Successful update of display.
< Update main CPU >	Successful update of inverter component.
< Update communication >	Successful update of communication component.
< Update RS485I module >	Successful update of communication interface.
< Upd. language table >	Successful update of language table.
< Update file OK >	The update file found is valid.

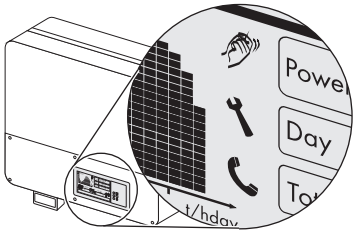
10.2 Error messages

When errors occur, a display message including the corresponding event number will appear in the text line of the display. By tapping on the enclosure lid, multi-line messages can be switched further.

If the error persists for a prolonged period, the red LED lights on and the fault signaler is activated (if connected).

In addition, depending on the severity of the fault the "wrench" or "telephone receiver" symbol on the display will light up.

- Wrench: signifies a failure which can be remedied on site.
- Telephone receiver: signifies device failure Contact the SMA Service Line.



Event no.	Display message and cause	Corrective measures
1	< Grid fault > The grid voltage has exceeded the permissible range. This error can have the following causes: • The grid voltage at the point of connection of the inverter is too high. • Grid impedance at the connection point of the inverter is too high. For safety reasons, the inverter disconnects itself from the grid.	• Check the grid current and grid connection on the inverter. If the grid voltage lies outside the acceptable range because of local grid conditions, ask the utility provider if the voltage can be adjusted at the feed-in point or if it would agree to changes in the values of the monitored operational limits. If the grid voltage lies within the tolerance range, yet this error is still being displayed, contact the SMA Service Line.
2	< Grid fault > The grid voltage has fallen below the permissible range. This error can have the following causes: • Grid disconnected • AC cable damaged • The grid voltage at the point of connection of the inverter is too low. For safety reasons, the inverter disconnects itself from the grid.	• Check the triggering of the line circuit breaker. • Check the grid current and the grid connection on the inverter. If the grid voltage lies outside the acceptable range because of local grid conditions, ask the utility provider if the voltage can be adjusted at the feed-in point or if it would agree to changes in the values of the monitored operational limits. If the grid voltage lies within the tolerance range, yet this error is still being displayed, contact the SMA Service Line.

Event no.	Display message and cause	Corrective measures
3	< Grid fault > The average grid voltage over 10 minutes is no longer within the permissible range. This can have the following causes: • The grid voltage at the point of connection of the inverter is too high. • Grid impedance at the connection point of the inverter is too high. The inverter disconnects to assure compliance with the voltage quality of the grid.	• Check the grid voltage at the point of connection of the inverter: If due to local grid conditions the grid voltage exceeds the configured limiting value, ask the utility provider whether the voltage can be adjusted at the feed-in point, or whether it would agree to a modification of the limiting value for voltage quality monitoring. If the grid voltage is continually within the acceptable range, and this error is still displayed, contact the SMA Service Line
4	< Grid fault > The inverter has left the grid parallel operation and for safety reasons interrupted feeding-in.	• Check the power supply line for strong, short-term frequency variations.
5	< Grid fault > The grid frequency is not within the permissible range. For safety reasons, the inverter disconnects itself from the grid.	• If possible, check the grid frequency and observe how often major deviations occur. If repeated frequency variations occur and as a result this error occurs, ask the utility provider if it would agree to modify the operating parameter. Discuss the proposed parameters with the SMA Service Line.
6	< Grid fault > The internal inverter monitoring has detected an impermissibly high proportion of direct current in the grid current.	• Check the grid connection for direct current. • If this is a recurrent phenomenon, check with the utility provider whether it is possible to raise the limiting value of monitoring.
7	< Frq. not permitted > The grid frequency has left the allowable range. For safety reasons, the inverter disconnects itself from the grid.	• As far as possible, check the grid frequency and observe how often major fluctuations occur. If repeated frequency variations occur and as a result this error occurs, ask the utility provider if it would agree to modify the operating parameter. Discuss the proposed parameters with the SMA Service Line.

Event no.	Display message and cause	Corrective measures
8	< Waiting for grid voltage > < Grid failure > < Check fuse >	• Check fuse. • Check AC installation. • Check whether there is a general black-out.
9	< PE conn. missing > < Check connection >	• Check AC installation. • Connect the PE cable to the AC terminal as described in section 5.3.2 "Connecting the Inverter to the Public Grid (AC)" (page 28).
10	< L / N swapped > < Check connection >	• Adjust the connection as described in section 5.3.2 "Connecting the Inverter to the Public Grid (AC)" (page 28).
11	< Installation fault > < Check connection > Second phase connected to N.	• Adjust the connection as described in section 5.3.2 "Connecting the Inverter to the Public Grid (AC)" (page 28).
33	< Unstable operation > The supply at the DC input of the inverter is not sufficient for stable operation. The reason for this could be snow-covered PV modules.	• Wait for higher irradiation. • If this event recurs at medium irradiation, check the PV system design and correct the connection of the PV generator.
34	< DC overvoltage > < Disconnect generator > The DC input voltage connected to the inverter is too high.	• **Immediately disconnect the inverter from the PV generator, as described in section 7.2 "Opening the Inverter" (page 53)! Otherwise, the inverter may be destroyed.** • Check the DC voltage of the strings for adherence to the maximum input voltage of the inverter, before you re-connect the inverter to the PV generator.
35	< Insulation resist. > < Check generator > The inverter has detected a ground fault in the PV generator.	• Check the strings for ground faults, as described in section 11.1 "Checking the PV Generator for a Ground Fault" (page 68). • The installer of the PV generator must remedy the ground faults before you re-connect the affected string.

Event no.	Display message and cause	Corrective measures
36	< High discharge curr. > < Check generator > The discharge current from the inverter and the PV generator is too high. This can be caused by a sudden grounding fault, failure current or an actual fault in the device. The inverter interrupts grid feed immediately after exceeding a limiting value and then automatically re-connects to the grid.	• Check the strings for ground faults, as described in section 11.1 "Checking the PV Generator for a Ground Fault" (page 68). • The installer of the PV generator must remedy the ground faults before you re-connect the affected string.
37	< Resid.curr.too.high > < Check generator >	• Check the strings for ground faults, as described in section 11.1 "Checking the PV Generator for a Ground Fault" (page 68). • The installer of the PV generator must remedy the ground faults before you re-connect the affected string.
38	< DC overcurrent > < Check generator > An overcurrent condition occurs on the DC side of the inverter and it switches off.	If this event occurs often: • Check the layout and the wiring of the PV generator.
39	< Waiting for DC start conditions > < Start cond. not met > The input power or the voltage of the PV modules is not sufficient for feeding into the grid.	• Wait for higher irradiation. • If this event recurs at medium irradiation, check the PV system design and correct the connection of the PV generator.
60 - 64	< Self diagnosis > < Interference device >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
65	< Self diagnosis > < Overtemperature > Inverter switches off due to excess temperature.	• Ensure sufficient ventilation. • Check heat dissipation, as described in section 8.1 "Checking Heat Dissipation" (page 58).
66	< Self diagnosis > < Overload >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).

Event no.	Display message and cause	Corrective measures
67	< Comm. disturbed > A fault has occurred in the internal communication of the inverter. However, the inverter continues feeding into the grid.	If this event occurs often: • Contact the SMA Service Line • (see section 15 "Contact" (page 82)).
68	< Self diagnosis > < Input A defective >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
69	< Self diagnosis > < Input B defective >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
70	< Sensor fault fan permanently on >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
71	< SD card defective >	Re-format the SD card. • Re-save the files to the SD card.
	< Parameter file not found or defective >	• Copy the parameter file into the card drive:\PARASET directory.
	< Param. setting failed >	• Check the parameters for valid values. • Ensure change rights via SMA Grid Guard Code.
	< Update file defect. >	• Re-format the SD card. • Re-save the files to the SD card.
	< No update file found >	• Copy the update file into the SD card drive:\UPDATE directory.
72	< Data stor. not poss. > Internal device fault: however, the inverter continues to feed in.	• If this fault occurs often, contact the SMA Service Line (see section 15 "Contact" (page 82)).

Event no.	Display message and cause	Corrective measures
73	< Update main CPU failed > Internal device fault.	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
	< Update RS485I module failed > Internal device fault: however, the inverter continues to feed in.	• Re-try update. • If this fault occurs again, contact the SMA Service Line (see section 15 "Contact" (page 82)).
	< Update BT failed > Internal device fault: however, the inverter continues to feed in.	
	< Upd. display failed > Internal device fault: however, the inverter continues to feed in.	
	< Update language table failed > Internal device fault: however, the inverter continues to feed in.	
74	< Varistor defective >	• Check the varistors as described in section 11.2 "Checking the Function of the Varistors" (page 70).
80	< Derating occurred > The delivered power of the inverter was reduced below nominal power due to a too-high temperature for more than 10 minutes.	If this event occurs often: • Ensure sufficient ventilation. • Check heat dissipation, as described in section 8.1 "Checking Heat Dissipation" (page 58).

Event no.	Display message and cause	Corrective measures
90	< Inst. code invalid > The SMA Grid Guard Code entered (personal installer password) is invalid.	• A valid SMA Grid Guard Code has been entered.
	< Grid param. locked > The current country data set is locked.	• Enter the valid SMA Grid Guard Code for changing the country data set.
	< Abort self-test >	• Contact the SMA Service Line (see section 15 "Contact" (page 82)).
	< Changing grid param. not possible > • The selected rotary switch setting for the country configuration is not programmed. • The parameters to be changed are protected. < Ensure DC supply > • DC voltage at the DC input is not sufficient to run the main CPU.	• Check the setting of the rotary switches (see section 5.4.2). • Enter the SMA Grid Guard Code. • Ensure sufficient DC voltage (green LED lights up or flashes).

11 Troubleshooting

11.1 Checking the PV Generator for a Ground Fault

If the inverter displays event number "35", "36" or "37", there is probably a ground fault in the PV generator.

Check the strings for ground faults as described in the following:

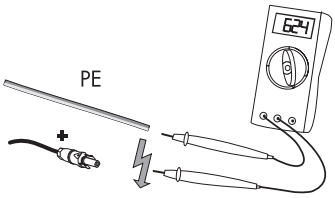
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).

Notice!

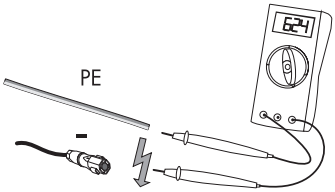
Excessive voltages can destroy the measuring device!

- Only use measuring devices with a DC input voltage range up to at least 1,000 V.

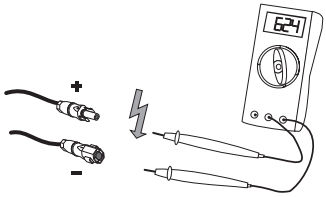
2. Measure the voltages between the plus pole of the strings and the ground potential (PE).



3. Measure the voltages between the minus pole of the strings and the ground potential (PE).



4. Measure the voltages between the plus pole and the minus pole of each string.



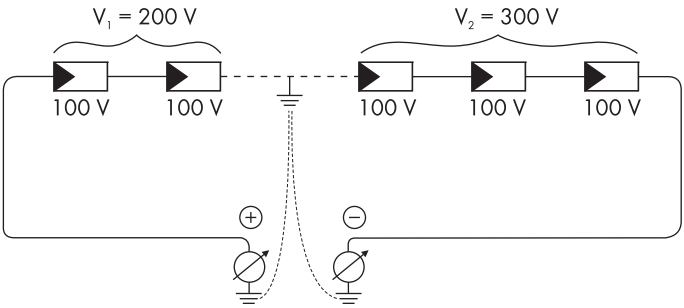
☑ If the voltages measured are stable and the total of the voltages from the plus pole against ground potential and the minus pole against ground potential of a string roughly corresponds to the voltage between the plus pole and minus pole, then there is a ground fault.

Result	Measure
☑ You have found **a** ground fault.	• The installer of the PV generator must remedy the ground fault in the affected string before you may reconnect the string to the inverter. The illustration below shows the location of the ground fault. • Do not reconnect the faulty string. • Re-commission the inverter as described in section 6.1 "Commissioning the Inverter" (page 50).
☑ You have **not** found a ground fault.	It is likely that one of the thermally monitored varistors is defective. • Check the function of the varistors as described in section 11.2 "Checking the Function of the Varistors" (page 70).

Location of the ground fault

The approximate position of the ground fault can be determined from the ratio of the measured voltages between the plus pole against ground potential (PE) and the minus pole against ground potential (PE).

Example:



In this case, the ground fault is between the second and third PV module.

☑ The ground fault check is finished.

11.2 Checking the Function of the Varistors

If the inverter displays the event number "74", then one of the varistors is probably defective.

Varistors are wear parts. Their functional efficiency diminishes with age or following repeated responses as a result of overvoltages. It is therefore possible that one of the thermally monitored varistors has lost its protective function.

Check the varistors as described below:

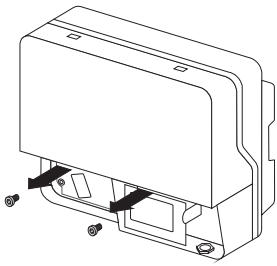
1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).

DANGER!

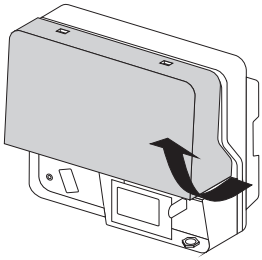
Danger to life due to high voltages in the inverter.

- Wait 5 minutes before opening the upper lid, in order to allow time for the capacitors to discharge.

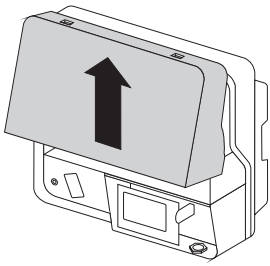
2. Release the upper lid screws.



3. Pull the lid at the upper edge towards the front.



4. Push the lid upwards and remove it.



NOTICE!

Damage to the inverter through electrostatic discharges.

Components on the inside of the inverter may be irreparably damaged due to electrostatic discharge.

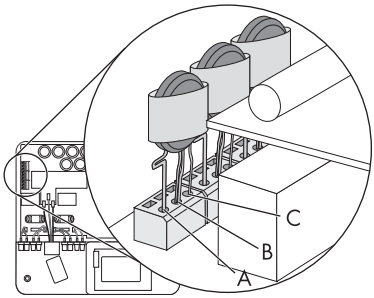
- Ground yourself before you touch a component.

Position of Varistors

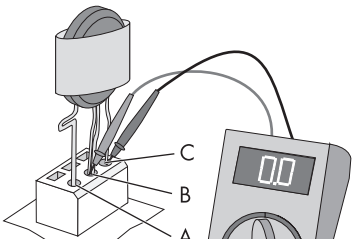
You can determine the position of the varistors using the illustration below.

Observe the following allocation of the terminals:

- Terminal A: outer terminal
  (Varistor connection **with loop** [crimp])
- Terminal B: middle terminal
- Terminal C: outer terminal
  (Varistor connection **without loop** [crimp])



5. Use a multimeter to ensure that all of the varistors in the installed state have a conducting connection between connectors B and C.



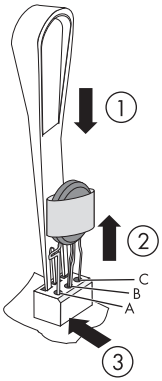
Result	Measure
☑ There is a **conducting** connection.	There is probably a different fault in the inverter. • Continue with step 9. • Contact the SMA Service Line (see section 15 "Contact" (page 82)).

Result	Measure
☑ There is **no conducting** connection.	The respective varistor is defective and must be replaced. Varistor failure is generally due to influences which affect all varistors similarly (temperature, age, induced overvoltage). SMA Solar Technology AG recommends that you replace both varistors. The varistors are specially manufactured for use in the inverter and are not commercially available. You must order replacement varistors directly from SMA Solar Technology AG (see section 14 "Accessories" (page 81)). • To replace the part, proceed to step 6.

6. Insert an insertion tool into the openings of the terminal contacts (1).

   ☑ This releases the terminals.

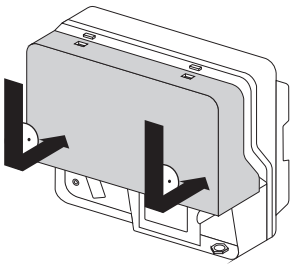
   If you do not receive an insertion tool for operating the terminal clamps with your replacement varistors, please contact SMA Solar Technology AG. As an alternative, the terminal contacts can be operated using a 3.5 mm wide screwdriver.



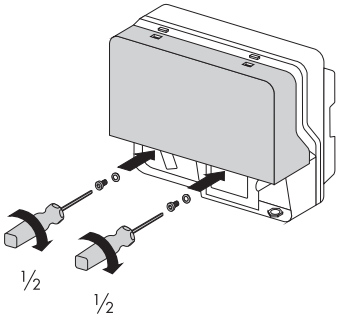
7. Varistor entnehmen (2).
8. Insert new varistor (3).

   The pole with the small loop (crimp) must be mounted into terminal A when reinstalling it (3).

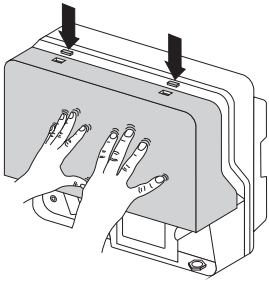
9. Attach the lid so that it is in a vertical position.



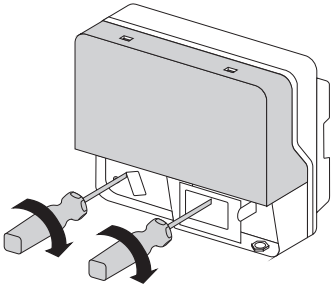
10. Fasten the screws and the washers half way.



11. Press the lid on the enclosure until it locks into place at the top.



12. Tighten both lid screws with 2 Nm torque.



13. Close the lower lid and re-commission the inverter as described in section 7.3 "Closing the Inverter" (page 56).

☑ The check and replacement of the varistors is completed.

12 Decommissioning

12.1 Dismantling the Inverter

1. Open the inverter as described in section 7.2 "Opening the Inverter" (page 53).
2. If connected, remove communication cables from the inverter.

CAUTION!

Parts of the enclosure can become hot - risk of burn injuries!

- Wait 30 minutes before disassembling until the enclosure has cooled down.

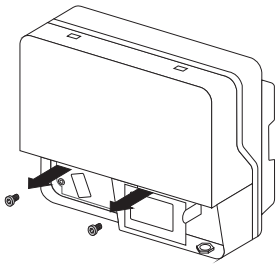
3. If mounted with top hat rail: undo screw between wall and enclosure.
4. If necessary, open anti-theft lock.
5. Push the inverter to the left and remove from the wall-mount or the top hat rail.

12.2 Replacing the Enclosure Lid

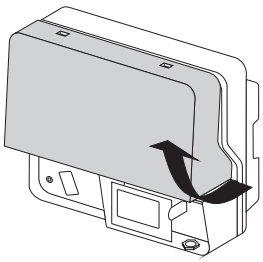
In the event of a fault it can be that your inverter must be replaced. If this is the case, you will receive a replacement device fitted with transport lids.

Prior to returning your inverter to SMA Solar Technology AG, you must swap over the upper and lower lids of your inverter with the transport lid.

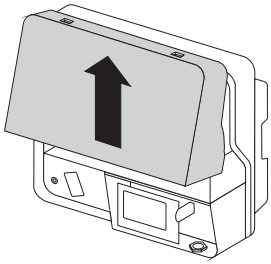
1. Dismantle the inverter as described in section 12.1 "Dismantling the Inverter" (page 74).
2. Release the upper lid screws.



3. Pull the upper lid at the lower edge towards the front.



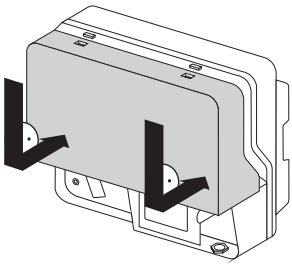
4. Push the lid upwards and remove it.



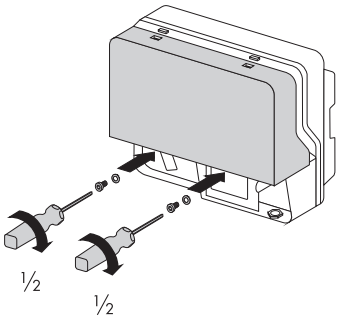
5. Remove the transport lid from the replacement device in the same manner.

Now mount the two transport lids of the replacement device onto your inverter:

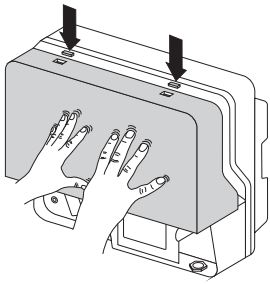
1. Place the upper lid so that it is in a vertical position.



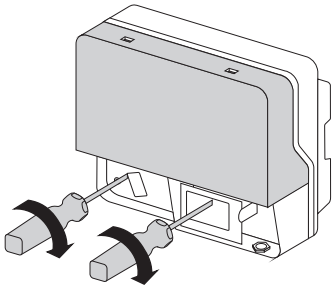
2. Fasten the screws and the washers half way.



3. Press the upper lid on the enclosure until it locks into place at the top.



4. Tighten both lid screws with 2 Nm torque.



5. Screw the lower lid tight.
   ☑ Your inverter is now ready to be sent back to SMA Solar Technology AG.
6. Now mount the upper lid of your inverter onto the replacement device in the same manner.
7. Mount (see section 4 "Mounting" (page 14)) and connect (see section 5 "Electrical Connection" (page 23)) the replacement device.

12.3 Packaging the Inverter

- If the original packaging is available, the inverter should be packed in its original packaging.
- If the original packaging is not available, use a cardboard box suitable for the weight and size of the inverter.

12.4 Storing the Inverter

Store the inverter in a dry place where ambient temperatures are always between -25 °C and +60 °C.

12.5 Disposing of the Inverter

Dispose of the inverter at the end of its service life in accordance with the disposal regulations for electronic waste which apply at the installation location at that time. Alternatively, send it back to SMA Solar Technology AG with shipping paid by sender, and labeled "ZUR ENTSORGUNG" ("FOR DISPOSAL") (for contact, see section Page 82).

13 Technical Data

DC Input

Maximum DC power at cos φ = 1	3 880 W
Maximum DC voltage*	550 V
MPP voltage range at AC nominal power	175 V ... 440 V
DC nominal voltage	400 V
Minimum DC voltage	125 V
Start voltage, adjustable	150 V
Maximum input current	2 x 15 A
Maximum input current per string	15 A
Number of MPP trackers	2
Strings per MPP tracker	2

* The maximum open circuit voltage, which can occur at a cell temperature of – 10 °C, may not exceed the maximum input voltage.

AC Output

AC nominal power at 230 V, 50 Hz	3 680 W
Maximum AC apparent power	3 680 VA
Nominal AC frequency	220 V / 230 V / 240 V
Nominal AC current at 220 V / 230 V / 240 V	16 A / 16 A / 15,3 A
Maximum AC current	16 A
Total harmonic distortion of output current at AC THD voltage < 2 %, AC power > 0.5 AC nominal power	≤ 3 %
AC voltage range*	180 V ... 280 V
Nominal AC frequency*	50 Hz / 60 Hz
Operating range at nominal AC frequency 50 Hz	45 Hz ... 55 Hz
Operating range at nominal AC frequency 60 Hz	55 Hz ... 65 Hz
cos ϕ at nominal AC power	1
Supply phases	1
Connection phases	1
Overvoltage category**	III

* Depends on country configuration

** Voltage surge resistance in accordance with IEC 60664-1

Protective Devices

DC reverse-polarity protection	Short circuit diode
All-pole DC disconnection unit	Electronic Solar Switch, SUNCLIX DC plug connector
DC overvoltage protection	Thermally monitored varistors
AC short circuit protection	Current control
All-pole AC disconnection unit	Automatic disconnection device SMA Grid Guard 3
Maximum permissible fuse protection	32 A
Personnel protection	Insulation monitoring: $R_{iso} > 1$ M Ω All-pole sensitive residual current monitoring unit

Climatic conditions in accordance with IEC 60721-3-4, installation type C, class 4K4H

Extended temperature range	– 25 °C ... +60 °C
Extended humidity range	0 % ... 100 %
Extended air pressure range	79.5 kPa ... 106 kPa

Climatic conditions in accordance with IEC 60721-3-4, transport type E, class 2K3

Temperaturbereich	– 25 °C ... +70 °C

General data

Width x height x depth with Electronic Solar Switch	470 mm x 480 mm x 180 mm
Weight	25 kg
Length x width x height of packaging	594 mm x 594 mm x 360 mm
Transport weight	28 kg
Operating temperature range	– 25 °C ... +60 °C
Maximum operating altitude above mean sea level	2,000 m
Noise emission, typical	≤ 25 dB(A)
Internal consumption in night mode	< 0.5 W
Topology	transformerless
Cooling concept	convection
Electronics protection rating*	IP65
Connection area protection rating*	IP54
Protection class**	I

* According to EN 60529

** in accordance with IEC 62103

Features

DC connection	SUNCLIX DC plug connector
AC connection	Spring terminal
Display	LC graphic display
Bluetooth	Standard
RS485, galvanically isolated	optional
Multi-function relay	Standard

Electronic Solar Switch (ESS)

Electrical service life in the event of a short circuit, with a nominal current of 35 A	A minimum of 50 switching operations
Maximum switching current	35 A
Maximum switching voltage	800 V
Maximum PV power	12 kW
Protection rating when plugged	IP65
Protection rating when unplugged	IP21

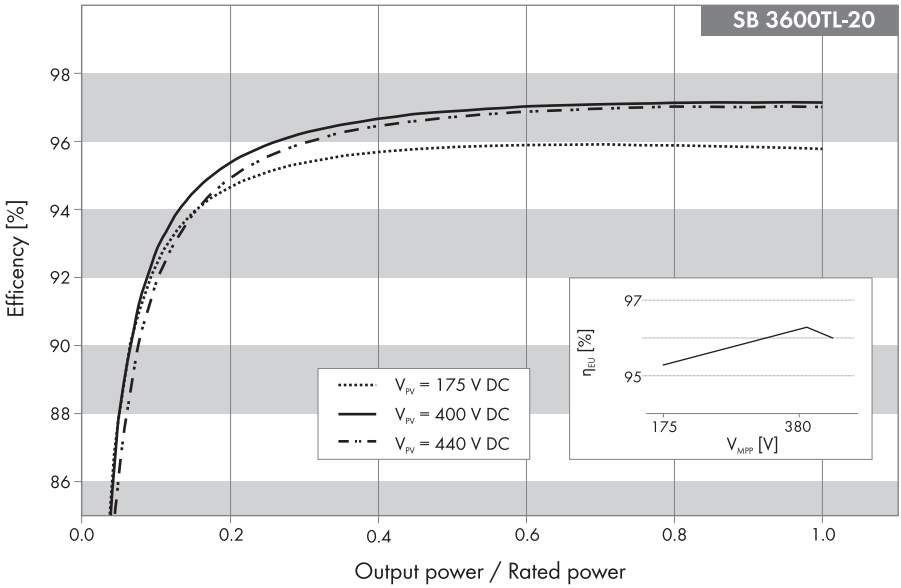
Torque

Upper lid screws	2.4 Nm
Lower lid screws	1.5 Nm
Additional ground terminal	6 Nm
SUNCLIX lock nuts	2 Nm

Grid forms

TN-C	Suitable
TN-S	Suitable
TN-C-S	Suitable
TT	Suitable, if $U_{N\_PE} < 30$ V

Efficiency



Maximum efficiency	η_{max}	97.0 %
European efficiency	η_{EU}	96.3 %

14 Accessories

You will find the corresponding accessories and replacement parts for your product in the following overview. If required, you can order these from SMA Solar Technology AG or your dealer.

Description	Brief description	SMA order number
Replacement varistors	Set of thermally monitored varistors	MSWR-TV8 (3 units)
ESS handle	Electronic Solar Switch holder as spare part	ESS-HANDLE:05
RS485 upgrade kit	RS485 interface	DM-485CB-10
SUNCLIX DC plug connector	Field plug for conductor cross-sections of 2.5 mm² ... 6 mm²	SUNCLIX-FC6-SET

15 Contact

If you have technical problems concerning our products, contact the SMA Service Line. We require the following information in order to provide you with the necessary assistance:

- Inverter type
- Inverter serial number
- Type and number of PV modules connected
- Event number or display message of the inverter
- Type of communication, if applicable
- Type of external wiring of multi-functional relay

SMA Solar Technology AG

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www.SMA.de

SMA Service Line

Inverters: +49 561 9522 1499

Communication: +49 561 9522 2499

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E-Mail: ServiceLine@SMA.de

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SMA Factory Warranty

The current guarantee conditions come enclosed with your device. These are also available online at www.SMA.de and can be downloaded or are available on paper from the usual sales channels if required.

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